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# **CENTERS • OF EXCELLENCE**

## **❖ REPORT TO THE UTAH STATE LEGISLATURE**

**Fiscal Year 1995-1996**

**December 1996**

# Utah Centers of Excellence Program

FY 95-96 Advisory Council

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# State of Utah

Michael O. Leavitt, Governor

DEPARTMENT OF COMMUNITY AND ECONOMIC DEVELOPMENT  
DIVISION OF BUSINESS AND ECONOMIC DEVELOPMENT

*Joseph A. Jenkins, Executive Director*  
*Richard J. Mayfield, Division Director*

**December 1996**

## **To Recipients of the Utah Centers of Excellence Program Annual Report**

Attached is the annual Report to the Legislature for the Utah Centers of Excellence Program. The report summarizes the achievements of the program during the fiscal year from July 1, 1995 through June 30, 1996 and in addition summarizes the funding allocations for the current 1996-97 fiscal year. The format of the report has been somewhat altered this year to provide special emphasis to centers related business activity and to program enhancements.

### **Report Format**

Since the founding of the Centers of Excellence Program in 1986, the Annual Legislative Report has summarized the financial and business accomplishments in terms of dollars granted, matching funds received, jobs created in both centers and businesses, and other statistical data. While this information continues to provide appropriate measures of the status of the program, and is contained in this report in Appendices A and B, the centers office has decided this year to substantially alter the format of the report.

We have realized for some time that, even though every effort has been made to assure the accuracy of the statistical data, there was always significant subjectivity in the summary of the numbers and in their interpretation. This has led to a general consensus that the numbers did not accurately reflect the true contribution of the Centers of Excellence Program to Utah's economic health; some believing the case was overstated and some feeling that there was insufficient credit claimed. Depending on any specific situation, both arguments contained some truth. We intend this year, by focusing on specific business activity related to the centers program, to provide more meaningful information relating to the overall impact which the program is having on Utah's economic vitality.

### **Centers Related Business Activity**

This years annual report has been organized to focus on a selected group of Utah companies that are making significant impact on the Utah business scene. This impact is demonstrated not only in terms of revenue and jobs created but also in the enhancement of Utah's reputation as a bastion of world class technology. All of the companies reviewed share a common heritage in that each bases its revenue stream on technologies developed at funded Centers of Excellence and have licensed those technologies from Utah universities. In each company report we have invited Chief Executive Officers to comment on the impact that centers funding has had on their enabling technologies. Our intent is to review the Centers of Excellence program from the standpoint of its influence over some of Utah's most important high tech companies. We hope to demonstrate that the funding of the program represents an incredibly valuable investment in Utah's current economic base and in the on-going development of her high technology industries.

### **Program Enhancements**

In this report we have also highlighted the most current efforts being made to further enhance the effectiveness of the program. Two years ago the centers program instituted a commercialization consulting program designed to inject professional business research and management techniques into the process of launching new technologies into the business arena. It had been observed in

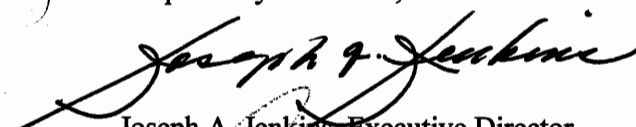


previous years that many centers directors did not have the time or often the expertise to initiate successful commercial ventures and that as a result commercial successes were often achieved haphazardly if at all. The expectation of this new initiative has been that by managing the process in a more professional way, the centers program would have opportunity to significantly enhance its impact on economic development. While this consulting initiative is still very young and has not had time to fully realize its potential, there have already been noteworthy accomplishments both in actual economic impact and in our understanding of the dynamics of the centers program. A major section of this report has been devoted to an in-depth analysis of the commercialization consulting program and its accomplishments to date.

During the fiscal year reported, the centers program issued over \$2.3 million in grants to 21 active centers and one distinguished center for their use in bringing significant new technologies closer to the marketplace. Matching funds in excess of \$104 million were also received by these centers. The matching fund ratio of 11.7 to 1 is believed to be the highest in the nation for programs of this kind and represents a critically important leverage for success in the program. Key statistical summaries are provided in Appendices A and B of this report.

The Centers of Excellence Program continues to be one of the nation's most successful technology commercialization programs as measured by matching dollars, significant new commercialized products, and state economic impact. We believe that with a continued and strengthened emphasis on the importance of commercialization and with the on-going support of the new enhancements described, the Centers of Excellence Program will have an ever expanding and important role to play in Utah's economic future.

Respectfully submitted,




Joseph A. Jenkins, Executive Director  
Department of Community and Economic Development



Richard J. Mayfield, Director  
Division of Business and Economic Development



Roderick J. Linton, Director  
Office of Technology Development



Rajiv K. Kulkarni, Ph.D., Assistant Director  
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# State of Utah

## GOVERNOR'S OFFICE OF PLANNING AND BUDGET

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December 20, 1996

Dear Legislator:

Enclosed, you will find the annual report for the Utah Centers of Excellence Program (UCOEP). As you know, the State Advisory Council on Science and Technology has responsibility for review and oversight of the Centers Program and, in addition to reviewing this report, actively interact with many of the Centers throughout the year. The Council believes this program to be one of the best uses of state funds for encouraging business development from science and technology developments within our research universities. Our world has been transformed by science and technology in this century and this transformation is continuing, even accelerating, as the century comes to a close. In order for Utah businesses to become and remain competitive in a global marketplace, we will need to continue this partnership and cooperation between university researchers and business development specialists. The Council strongly recommends continued financial support for this program.

The loss of competitiveness of U.S. industry in international markets is an extremely serious problem with wide-ranging consequence for our material well being, our security and our political influence. Its causes are many, but among them certainly is the slow rate at which new technology is embodied in commercial products and processes. We, as a nation have been slow to capitalize on new technology developed from our own intellectual capability. The Centers Program has demonstrated its success in addressing this need in Utah by effectively encouraging the transfer of university research and technology to Utah's business community. We have successfully leveraged state funds, facilitating partnerships with federal programs and the investment of private investments to promote new, technology based business. Additionally, we believe this program strongly encourages university faculty to focus attention in areas not otherwise addressed.

The number of spin-off companies, the matching dollars brought to our state, and the jobs created both within the Centers and in the industrial sector are testament to the strength of this vital economic development program. To take advantage of emerging technology markets and to maximize taxpayer investment, the Council strongly recommends you continue funding this program at the current annual level of \$2.5 million.

Respectfully submitted,

Suzanne Winters, Ph.D.  
State Science Advisor

# Utah Centers of Excellence Program

Report to the Legislature

FY1995-96

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# **I. EXECUTIVE SUMMARY**

# Utah Centers of Excellence Program

## Fiscal Year 1995-96

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### I. EXECUTIVE SUMMARY

#### **Background of Program**

The Utah State Legislature created the Centers of Excellence Program (COEP) in 1986 recognizing that the growth of new industry and expansion of existing industry requires a strong technology base, new ideas, concepts, innovations, and prototypes. The Legislature recommended the allocation of economic development funds each year to the Centers of Excellence Program, to be awarded to college and university faculty on a competitive basis. The primary purposes of the Centers of Excellence Program are to enhance and expand the applied technical research activities at institutions of higher education in Utah, to develop technologies that are considered to have potential for economic development in the state, and to assist in the actual commercialization of those technologies. This research and technology commercialization process ultimately results in the creation of new companies, the enhancement of business opportunities for existing companies that license centers technologies, and in the growth of Utah's job opportunities. In addition, the proprietary value of technologies created is reflected in the number of patents issued and the associated royalty-bearing licenses which are signed.

Traditionally, these measurement parameters (jobs created, companies assisted and/or created, patents disclosed or issued, and license agreements signed) have been reported each year to the legislature as indicators of the value of the centers program to state economic development. This report will continue to report these parameters as accurately as possible and, in addition, will highlight some of the specific business activities currently underway in Utah that have been materially influenced by Centers of Excellence funding.

On-going funding of the program has been based upon the real and potential economic impact which the Centers of Excellence Program has had upon the State of Utah during the years since its creation. This annual legislative report summarizes the significant accomplishments of the program during the recently completed fiscal year and attempts to identify the long term economic value of that work.

#### **Program Operations and Objectives**

The operating methods of the centers program have evolved over the years since its inception with a continuing goal of achieving the maximum economic benefit from the individual centers that have been created.

Upon selection on a competitive basis, new centers are funded with a requirement for a minimum 2:1 matching-fund ratio from the private and federal sectors. Matching funds are reported and audited on a regular basis. Centers are also audited regularly for the achievement of technical and commercial milestones. Center directors are required to submit semi-annual reports to the centers program director. The Centers of Excellence Program Annual Report, here attached, is based on submitted reports and upon information gathered in site visits, audits and other data sources. In addition, each funded center is assisted by one or more designated commercialization consultants who assist centers directors in defining commercialization strategies, performing market and competitive analyses, locating potential investors, etc.

Centers are normally expected to be self-sustaining through license contract royalties and new research grants at the end of five years and are then graduated. Centers with especially noteworthy histories and on-going technological impact are designated as Distinguished Centers and thereafter may be funded on a project by project basis as



requests are approved. One distinguished center, the Center for Advanced Combustion Engineering and Research (ACERC) at Brigham Young University was funded in the 1995-96 period.

### **Center Selection Process**

Proposals from researchers to create or renew existing Centers of Excellence are submitted to the centers office in response to a "Request for Proposal" which is normally sent in late December. The incoming proposals are submitted to the National Institute of Standards and Technology for scientific peer review and are thoroughly reviewed by the Centers of Excellence Advisory Council. Centers are selected for funding based on a ranking established in extended review sessions with the Centers Advisory Council.

Since its inception, and through FY 1995-96, the program has created sixty Centers of Excellence, seven of which have been designated as Distinguished Centers. Twenty-six have graduated, and twenty are active during this reporting period.

The State Advisory Council for Science and Technology has oversight responsibility for the Centers of Excellence Program. Members of the council have reviewed this report for content (see cover letter from the State Science Advisor, Dr. Suzanne Winters) and have approved it. The Director of the Office of Technology Development, serves as an ex-officio member of the State Advisory Council for Science and Technology.

### **Commercialization Process**

Over the past two years, the Centers of Excellence Program has funded a consulting program to assist center directors in preparing and implementing commercialization strategies. Each center is unique in terms of which strategy is optimum - there is no single solution and each requires customized approaches.

Early market surveys and competitive analyses are conducted to discover which market segments are most promising and which product features will be

of interest to potential customers and licensees. Consultants assist in targeting potential licensees for the technology and in positioning products for anticipated markets.

These early strategic discussions often reveal product variations that can be introduced to the marketplace earlier than previously planned. Such early commercialization has several benefits:

- getting products to consumers for preliminary market validation and directional planning;
- early cash flow strengthens continuing research at the center and hastens financial independence and;
- the future value of technology licenses are enhanced.

The Centers of Excellence office works closely with the Technology Transfer Offices at the respective universities in an effort to extract maximum value from the licenses that are signed for centers technologies. Through the commercialization consulting program assistance is given in defining market opportunities, identifying potential target licensees, providing key information for license valuations, and consulting assistance to those companies considering license opportunities.

During the fiscal year reported, the centers program granted \$2,312,000 to 20 active centers, \$70,000 in planning grants, and \$100,000 to the commercialization consulting program. The program realized a cumulative 11.7:1 matching fund ratio of federal/Industrial dollars to state dollars. Financial and economic impact summaries are found in appendices A and B.



## **II. CENTERS RELATED BUSINESS ACTIVITY**

**The following section provides a summary of recent business activity in a selected group of key Utah businesses whose revenues are based upon technology licenses signed with Centers of Excellence either currently or previously funded. Executives of the listed businesses were invited to submit information and to comment on the impact of the centers program on their commercial successes.**

# AGRI-PRODUCTS INC.

(Center for Meat Processing Technology)

***Where's the beef? USU technology sizzles with new product...Sandwich steak said to be grabbing bigger bite of world market***

Momentarily putting aside his role as a plant supervisor at Feller's Precooked Meats, Mike Martin talked of the sandwich-sized steaks produced by the North Salt Lake meat production plant like any impressed consumer. "I cook it about three-and-a-half minutes. That keeps the juices in. And it's good."

Just the kind of endorsement the steak's inventor, Von Mendenhall, director of the Center for Meat Processing Technology at Utah State University, wants to hear. Mendenhall spent the better part of the five years (July 1991-June 1996) that the center was funded by the Centers of Excellence Program developing an easy-to-prepare, healthy beef product. The result of his lab work is a four-ounce sandwich steak dubbed "FlashGril'd."

The uniqueness of "FlashGril'd" is in its preparation. During production at Feller's, the steaks pass through an ultra-high temperature oven, Mendenhall's patented process whereby the surface of each piece of meat is seared by 2,000 degree Fahrenheit heat to kill any germs. Grill marks are even burned onto the steaks giving them a barbecued look. The meat is frozen for delivery to customers. A few minutes in a microwave oven has it ready to eat. Each steak has just seven grams of fat and is low in cholesterol.

But can it sell? The answer appears to be "yes", based on marketing efforts that began in earnest earlier this year. "There's nothing else on the market like it," claims Lenny Goodwin, chief executive officer of Agri-Products, Inc., Inc., the Salt Lake City firm that markets the product in the U.S., Canada, and parts of Southeast Asia. "Sales are growing at the rate of 50% to 75% per month," Goodwin adds, while acknowledging that those percentages are still based on relatively small quantities. Quick-Grill Products and Bakker, both of The Netherlands, market and produce the steaks,

respectively, in Europe under separate license agreements with the Center for Meat Processing Technology.

Agri-Products, Inc. pitches the product to restaurant chains such as Hardee's and Shoney's, food service operations, and at food shows. Goodwin says restaurants pay about \$1.40 per steak, which come in boxes of 12 or 40 steaks. Two of the more notable customers are Ford Motor Company's food services and the recent Summer Olympics in Atlanta, where the steaks were consumed by members of the huge press corps. Colleges and universities are also proving to be big customers. Shoppers in retail supermarkets, though, may have to wait a while for the meat, perhaps a year or two. "It is expensive to launch a retail product. We want to be a success as a food service product before we launch as a retail product," Goodwin said.

Feller's plant supervisor Mike Martin says ten workers are producing about 3,000 pounds of "FlashGril'd" steaks per day. That output fluctuates, depending on sales consummated by Agri-Products, Inc., but is rapidly increasing. Kelly Feller, president and CEO of the meat-packing business, says production could hit 12,000 pounds a day by the end of this year. Additional Utah meat plants may be recruited if production goes beyond that.



# MYRIAD GENETICS, INC.

(Center for Cancer Genetic Epidemiology)

A Salt Lake City company, working hand-in-hand with the Center for Cancer Genetic Epidemiology has significant new insights into the genetic basis of some common cancers including breast, cervical, and prostate. The basic premise of the research and product development is that if genes can be identified that have clear association with these diseases, then humans can be screened for their tendencies to develop the diseases and potentially, therapeutic methods can be developed to prevent and/or cure the diseases.

Myriad Genetics, Inc. founded in 1991, is working to realize that hope. Myriad has defined two primary objectives:

- Providing genetic testing services to identify inherited gene mutations that predispose people to specific diseases, and
- developing new therapies based on the company's genetic discoveries, in conjunction with major corporate partners.

Much of the research upon which Myriad is based was conducted at the Center for Cancer Genetic Epidemiology at the University of Utah. The graduated center will continue to serve as the company's research arm in the future. "It was very important to the development of Myriad," says Dr. Mark Skolnick, director of the center and executive vice president of research at Myriad.

Two key discoveries that have given Myriad and the center worldwide renown are breast cancer genes labeled "BRCA1" and "BRCA2". They were found through a complex process in which researchers look at the sequencing of genes to trace any mutations that could lead to cancer. While that in itself won't stop the occurrence of breast cancer, it buys doctors a precious head start. "The best thing we can do is start surveillance earlier so that should breast cancer arise, it's detected very early when its treatable," says Bill Hockett, Myriad's director of corporate communications.

The company plans to market its BRCA1 and BRCA2 diagnostic kits, BRAC Analysis™, to make them more widely available to the medical community for detecting the presence of genetic defects leading to breast and ovarian cancer. "We have a sales force in place. We'll go out and talk to people in the cancer centers and the breast cancer programs," said Hockett. According to the American Cancer Society, in 1996 the national incidents of breast and ovarian cancers was 184,300 and 26,700 respectively.

Myriad's revenue picture is bright. Major sources of funding come from strategic alliances formed with corporate partners. Pharmaceutical giants Ciba-Geigy, Bayer, and Eli-Lilly have committed more than \$130 million to Myriad over the next few years for research of cardiovascular disease, osteoporosis, asthma, and obesity. In return, those companies get the rights to develop therapeutic products based on the results of Myriad's work. Myriad will also receive royalties from product sales. Such income is circulated back into the local economy through taxes and the purchase of goods and services from local vendors. Myriad recently infused millions of dollars more into the economy with the construction of its 48,000 square foot office and genetic-testing laboratory.

The company has a workforce of 175 researchers, technicians, administrative, and sales personnel. "It's growing very quickly," said Hockett. In October 1995, the company raised \$49 million through an initial public offering. (nasdq.MYGN)

\*See newspaper article on page 47



# ONE-STOP SATELLITE SOLUTIONS, INC.

(Center for Aerospace Technology)

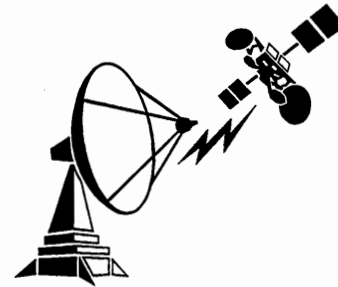
The Center for Aerospace Technology (CAST) at Weber state was completing its fifth year of center's funding when the commercialization consulting program was initiated. First visits from the assigned consultants were aimed at understanding all of the technology skills that had been developed at the center and to explore the potential commercial value of those skills. Two years later a new Utah business, OSSS (One Stop Satellite Solutions), has been launched with an eye on the rapidly expanding market for small commercial satellites.

The seed for what has now become OSSS was planted at CAST in the mid 1980's through its participation in satellite construction and launchings for scientific missions sponsored by NASA and other agencies. One such project was NUSAT I, a mere one-hundred pound satellite used as an educational tool for students, faculty, and volunteer engineers at WSU and Utah State University, and also as a tool that propelled CAST into the Centers of Excellence Program in 1989. Other examples include a team effort with the North America Amateur Radio Association in the construction of four small satellites which were launched from a French Ariane rocket in 1990. One of these satellites, dubbed WEBERSAT, is still in orbit today, assisting with imaging technology, student communication experiments, and other research projects. Other lightweight satellites, JAWSAT and CATSAT, with life spans of up to ten years, are scheduled to be launched in 1998. As a result of these projects, the center has developed significant expertise in the low cost design and manufacture of small satellites including basic functions such as platform stabilization, power distribution, on-board data processing, and ground communications. These skills now form the basis of the OSSS business strategy.

As budget cuts have reduced NASA's involvement in some missions, particularly small scientific applications and multi-satellite communications, the market for commercially developed small satellites

has begun to blossom. In addition NASA is backing away from contract launching of commercial satellites having decided that the new generation of space shuttles will be commercially owned. OSSS is optimally positioned to take advantage of these market developments.

Jay Smith, OSSS Vice President for Engineering, explains: "If we can demonstrate that mainstream



scientific research and small commercial applications can be achieved for less than ten percent of what it currently costs using NASA facilities, it will change the way the commercial development of space is accomplished."

"We are able to produce satellites from start to finish, from initial concept to integration with the ultimate launch provider." Smith describes OSSS as a "technology-transfer company" based on the research conducted by the Center for Aerospace Technology. The Center of Excellence will serve as the research and design arm of OSSS, enabling the new company to largely focus on marketing its products while contracting the early steps of the satellite design and construction process to CAST.

OSSS is in discussion with aerospace giants Lockheed Martin and McDonnell-Douglas, among others, and efforts by the centers commercialization consultants to line up other

industry partners are promising. Contacts are being made with such companies as GE Americom, Teledesic, and LEO The sky appears to be the limit for the small satellite businesses in the future.

\*See newspaper article on page 51



# PART.NET

(Center for Design Systems)

A growing Salt Lake City company is using software technology developed by a Center of Excellence to create a one-stop Internet shop that is enabling a growing number of businesses to electronically sell parts and equipment.

*Part.Net* has parlayed the research and development efforts of Dr. Don Brown, director of the Center for Design Systems at the University of Utah, into its own start-up via a unique online catalog linking engineers, designers, and others with parts suppliers. It allows businesses to post thousands of electronic, electromechanical, and mechanical parts for sale, and customers, such as the Department of Defense, for example, can scan those lists to find the items they need. The parts, in most cases, can then be ordered electronically.

The benefits are immediately obvious. Less time and less money are spent producing or sifting through bulky, space-consuming paper catalogs for

parts. The Sacramento Air Logistics Center in California discovered its procurement process was slashed from a seemingly interminable average of more than four months to just a few days. "When you've got an F-16 sitting on the ground without a part it needs, that down time costs a lot of money," says Dr. Brown.

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*"Without centers funding we wouldn't have made it." Dr. Don Brown*

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Sales of the center-developed software by *Part.Net* totaled \$100,000 in 1995. Projections for the current sales year are \$1 million. *Part.Net* has

eight full-time employees and four part-time. Most are software engineers. Brown says at least two more full-timers will be hired within the first quarter of 1997 and the staff will possibly grow to twenty by end of 1997. "Without Centers (of Excellence Program) funding, we wouldn't have made it," says Brown.

\*See newspaper article page 53



# SARCOS, INC.

## (Center for Engineering Design)

In the movie Jurassic Park, ferocious dinosaurs were created using ancient DNA samples recovered from insects trapped in amber. In real life, those same ferocious dinosaurs were created by a Utah based company called Sarcos.



In addition to robotic dinosaurs, Sarcos engineers and scientists have designed and built gorillas, former presidents, pirates, an array of alien humanoids and countless other fascinating products for the movie and entertainment industry. They have also involved themselves in more serious applications such as bio-medical prosthetic devices, military survival equipment, pharmaceutical pumps, simulators, microsensors, and remote actuators. Founded in 1983 by Dr. Stephen C. Jacobsen, Sarcos Inc. is a privately-held Utah corporation which has focused on research and development projects in collaboration with the Center for Engineering Design at the University of Utah, a distinguished Center of Excellence. Over the years since the collaboration began, university students and faculty at the Center for Engineering Design have provided a continuing stream of innovative core technologies which Sarcos has designed into a wide variety of commercial products under license agreements.

While the number of individual Sarcos products is too large to describe fully, the following examples will show the wide range of interesting technologies

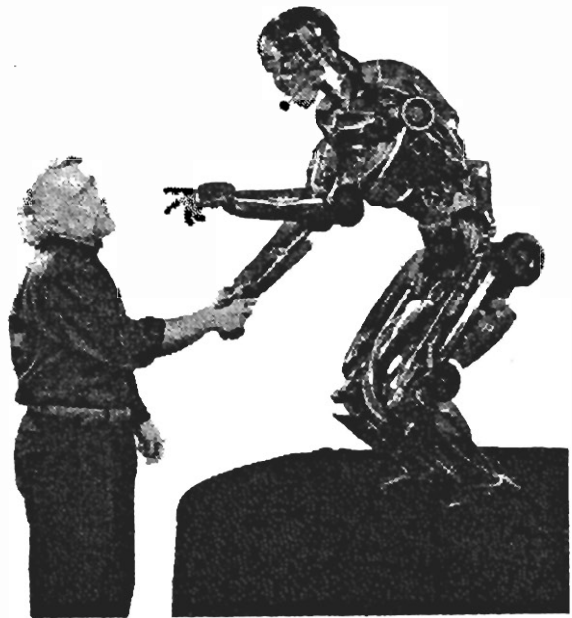
with which Sarcos has involved itself:

### **Intelligent Robotics**

Sarcos has designed intelligent robots for Walt Disney Imagineering, Universal Studios, MCA Recreation Services and other major companies. While the Sarcos robots are designed primarily for entertainment and display purposes, the underlying technologies are proving useful in medical prosthetic designs and in remote control applications.

### **• Dextrous hand and arm products**

These dextrous hand and arm products are artificial limbs which can be controlled electronically. Using a master glove, the human



operator is able to manipulate the units remotely with normal hand and arm motions. The devices have application in remote manufacturing and materials handling operations where remote or hostile environments prevent actual human presence.

### **• Microcatheters**

Sarcos' highly functional microcatheters represent a new class of minimally invasive, intravascular systems that include both

micromechanical and electrical features on their tips. Combining electronic, sensory, and mechanical features with the ability to move within the vascular system, provides systems that can access, diagnose, and treat diseases more efficiently and less traumatically than current catheters.

- **Personnel Status Monitoring system**

The Personnel Status Monitoring System (PSM) utilizes state of the art miniature physiological sensors, geolocators, microprocessors and spread spectrum radio telecommunication systems to provide real time monitoring of humans in remote locations. The system sends data regarding personnel vital signs and physical location to remote monitoring stations. The primary application would be for military personnel in combat situations to provide fast access of medical personnel to wounded or disabled soldiers.

- **Silicon based micro sensors and actuators**

Sarcos manufactures a wide range of microminiature, silicon-based sensors and mechanical actuators for use in many varied applications. Sensors include devices to measure pressure, temperature stress, and strain. Mechanical actuators include microminiature motors and microdrills. Applications for these devices include medical, aerospace, consumer products, toys, and manufacturing machinery.

Sarcos represents one of Utah's most fascinating, technology-based businesses. The company relies heavily on the on-going technological advances of the Center for Engineering Design at the University of Utah and on the continued collaboration with researchers and graduate students at the school. In 1995 Sarcos generated \$25 million in revenues and has a workforce of approximately 200 employees.





# TheraTech, Inc.

## (Center for Controlled Chemical Delivery)

Thanks to the research efforts of a Center of Excellence, a Salt Lake City company has developed into one of the world's top makers of innovative drug delivery products

TheraTech, Inc., in partnering with the Center for Controlled Chemical Delivery at the University of Utah, has grown into a 270-employee operation that manufactures and markets products such as transdermal patches, oral controlled-release products, oral transmucosal delivery systems, and permeation-enhanced topical preparations.

According to TheraTech, its products are "designed to optimize the rate and pattern of drug delivery; improve the safety and efficacy of the medications; and enhance patient convenience and compliance." Those technologies have enabled the firm to amass a combination of 36 issued or pending patents. One of the company's key products, approved by the Food and Drug Administration in 1995, is Androderm. It is a patch in which a man can receive controlled doses of testosterone to treat hypogonadism, where the body produces abnormally low levels of testosterone,

often leading to impotence, irritability, fatigue, and decreased muscle mass and strength.

TheraTech was founded in 1985 and went public seven years later. Its stock is traded on the Nasdaq National Market (symbol: THRT). The company has been able to focus its efforts on improving delivery systems for existing drugs, while the Center for Controlled Chemical Delivery has conducted the basic research. TheraTech has equity and/or licensing agreements with such pharmaceutical giants as Pfizer, Procter & Gamble, and SmithKline Beecham. The company's rapid growth is illustrated in figures which show 270 employees and revenues approaching \$25 million in 1995 compared to a staff of 47 and sales totaling just \$2.5 million five years earlier.

Dr. Dinesh Patel, President and CEO of TheraTech, says today's growth rests largely on the initial efforts of the Center for Controlled Chemical Delivery. "In the critical time, when we needed early expertise, the center was there for research and development."

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*"In the critical time, when we needed early expertise, the center was there for research and development."* Dr. Dinesh Patel,  
President and CEO

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## Utah Centers of Excellence Program

<b>New Spin-off Companies</b> <b>FY 1995-96</b>		
<b>Company Name and Address</b>		<b>Center</b>
<b>Paintbrush Productions</b>	P.O. Box 42 St. George, Utah 84770 (801) 652-7767	Center for 3-D Computer Graphics, Dixie College
<b>Combustion Resources</b>	1453 W. 820 N. Provo, Utah 84604 (801) 370-0654	Center for Advanced Combustion Engineering Research
<b>Soil Stabilization, Inc.</b>	4481 Park Hill Drive Salt Lake City, Utah 84124 (801) 272-1325	Center for Advanced Construction Materials
<b>One Stop Satellite Solutions, Inc.</b>	1805 University Circle Ogden, Utah 84408-1805 (801) 299-9900	Center for Aerospace Technology
<b>Utah Milk Technology</b>	372 W. Main Street Delta, Utah 84524 (801) 864-3818	Center for Dairy Foods Technology
<b>ErgoWeb</b>	75 E. 400 S. Salt Lake City, Utah 84111 (801) 323-9444	Center for Design Systems
<b>Part.Net</b>	505 Wakara Way Salt Lake City, Utah 84108 (801) 581-1118	Center for Design Systems
<b>HDG</b>	P.O. Box 966 Riverton, Utah 84065 (801) 254-7715	Center for Electronic Systems Technology

### **III. COMMERCIALIZATION HIGHLIGHTS**

### III. Commercialization Highlights

While the commercialization consulting program is still relatively young there have already been an impressive number of centers-based businesses which are underway and, in some cases, are generating substantial royalty revenues. The following Centers of Excellence case studies demonstrate the substantial benefits that are already developing from the consulting program.

#### **The Center For Meat Processing.**

Dr. Von Mendenhall at Utah State University has developed a process for increasing shelf life for meats and allowing re-processing of meat scraps into marketable steaks. The UHT process has been patented and licensed in Europe, Canada and the U.S. A market survey of national meat processing companies was undertaken to identify potential licensees and commercial clients. Twelve additional interested companies and seven possible commercial clients were identified. USU and its licensee are pursuing these leads. These contacts were turned over to the licensee.

USU reports that licenses have been signed for Europe, Canada, and the U.S. License fees of over \$150,000 have been received to date. The commercial marketing continues by the licensee and a continual royalty income stream is expected.

#### **Center for Neural Interfaces**

Dr. Richard Normann and his team at the University of Utah have invented a group of unique electrode arrays that can be implanted into mammalian brains. The research so far has involved cats and monkeys, but the long term goal is to use the electrode arrays and the associated hardware and software for human implants. The technology could, for example, enable a blind person to have some visual acuity by receiving pictures directly in the visual cortex from a micro television camera mounted on his or her head. Also, a deaf person could receive sound signals directly into the auditory cortex, and a paraplegic could use voluntary thoughts to control a robot or a wheelchair. In working on the strategic plan, it became apparent that although the market is potentially huge for these applications, it will likely be some seven to ten years before the

technology is sufficiently mature to be used in human applications.

The consultants and members of the center's staff developed a commercialization strategy based on the assumption that the devices developed at the center could be sold to other neuroscience laboratories as unique research tools. Marketing the devices as research tools required no governmental approvals or clinical trials and were therefore available immediately for market sales. The advantages of doing this early commercialization include:

- enabling other researchers to define uses for the electrode array devices;
- assists the center to focus on the product features and enhancements that are identified by other laboratories;
- assists strategically in preparing the ground for future human and clinical trials; and
- the income provides enhanced funding for the center to continue research activities.

The consultants assisted in forming Bionics, Inc., spin-off company, to market the devices to other researchers. A product development and manufacturing plan was drafted, financial projections prepared, and a commercialization plan outlined. Bionics, Inc. is now being incorporated in Utah and will involve several members of the center staff. The new company launched the first research products at a neuroscience conference this year and has already booked in excess of \$100,000 in product orders. Meanwhile, the center will continue to pursue its primary goal to develop neural probes for human applications.

#### **The Center For Value Added Seed Technology (CVAST)**

Dr. Grant Vest and the CVAST team at Utah State University are working in 3 areas of development: apomictic wheat, apomictic research, and drought resistant turf grasses. The first two technologies are currently in early stages of research and are not appropriate for immediate commercialization. The drought-resistant turf grasses have progressed significantly over the last five years through research developing products that requires low

maintenance, low water needs, have good spreading capability, and stay active during hot months. The long term goal has been to develop turf grasses with color and texture suitable for golf courses and parks. These park grasses will potentially save courses and cities significant watering and maintenance costs.

As work continues on the long term grass project, a strategy was developed to commercialize an early market product called roadside turf. Progress in cross breedings to date has produced a grass variety that, while not of the color and texture required for parks and golf courses, is potentially attractive for applications along freeways, in median strips, beside airport runways, etc. A commercialization strategy was developed as follows:

- Prepare an introduction and benefits brochure to be given to state roadside managers.
- Attend the national roadside managers conference (with a marketing table).
- Contact all the states in the western region to setup potential test plots.
- Follow up with test plots.
- Develop a commercialization strategy for licensing new seed varieties (High Crest II is the first species).
- Develop foundation seed to supply test plots.
- Develop additional seed for actual market penetration for 1997.

The roadside turf brochure and display were highly successful at the National Roadside Managers conference. The contacts obtained at the conference resulted in planned test plots in seven states throughout the Rocky Mountain area. The initial results of the test plots have been so successful that other test plots have been requested. A new market opportunity has also been identified in the airport runway vegetation. The foundation seed development continues and will provide an adequate supply for marketing in early 1997.

The High Crest II patent and licensing process is underway. A press release has been issued to alert potential seed companies and licensees that the new seed variety is available. A first response has been received with very favorable terms for USU. The commercialization consultants were able to

develop and implement a strategy to bring to market a commercial product from USU's turf research three to five years earlier than expected. In addition the United States golf association is interested in the actual golf course turf and has proposed to help fund a three year research project. The first license is expected in the fall of 1996 with major roadside turf product sales in late 1997.

### **The Center For Genetic Improvement In Livestock**

Dr. Noelle Cockett at Utah State University has developed gene tests to identify special characteristics in livestock. The initial test discovery was for *Callipyge* lambs which feature a 30% larger hind quarter. Additional tests for three other species are being researched.

The initial meeting of the consultants resulted in a strategy to control the tests rather than the breeding of the specie in a market. The strategy is to control the genetic test which can only be performed at the USU laboratory. Despite initial publication of the test, the team was able to secure the test and maintain control of the test at the USU laboratory.

The steps that have been taken to promote the test include:

- Publications.
- National conference in Salt Lake City.
- Additional research into other tests that could be controlled and run out of USU.
- Continued research to identify and sequence the genes.

The center has been highly successful in controlling and marketing the *Callipyge* gene test. Additional tests have been identified and promoted through the USU laboratory. The commercialization strategy continues to be formulated for new tests. The initial test work in 1995 resulted in over \$20,000 dollars of test revenue. The potential revenue for the gene tests could be into the millions of dollars depending on the market acceptance of *Callipyge* and other specific genetic breeds that require testing.



## **IV. FUNDED CENTERS**

**The following section is a listing of all the centers funded during the 1995-1996 fiscal year, including highlights of activities during the year and a summary of financial and economic impact information. Also a list of all planning grants funded during the fiscal year is included.**

# Center for Advanced Combustion Engineering Research

Director, L. Douglas Smoot, Brigham Young University, Provo, Utah  
Phone 378-2804, Fax 378-3831, e-mail mike\_king@byu.edu

## **Background**

Established in 1986 as a joint project between Brigham Young University and the University of Utah for the purpose of advancing combustion engineering research, education, and technology. The principle focus is on clean and efficient use of fossil fuels including coal, oil, and natural gas as well as the combustion of toxic and municipal solid wastes.

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*Received "Distinguished Center" status in 1991*

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## **Technology Development Progress**

Our nation's basic and high-technology industries rely upon the adequate supply of high-quality energy, the production of which depends upon combustion technology. The international competitiveness of these industries depends in part on their ability to more efficiently use low-cost fuel resources such as coal, heavy oil, oil shale, and tar sands, which are abundantly available in the western United States and particularly in Utah. Specific Center technologies include:

- Mechanisms of fossil-fuel combustion and pollutant and soot formation.
- The relationship between fuel properties and conversion.
- Computer models to control and record the performance of particular combustion chambers.
- Pollution formation/control and waste incineration.

## **Highlights and Accomplishments**

- The center has attracted **\$71 million** in matching funds over eleven years.
- New software licenses have been generated.
- The center provides consulting and technical services to Utah companies.
- The center has provided **new technology for Utah companies** such as **REI, Inc., and Geneva Steel Company.**
- New technology and software products from the center have led to the creation of **six new businesses in Utah.**
- The center is one of 18 highly sought-after national engineering centers.



## **Summary Data:**

### **Current**

1995-96 Award .....	\$100,000
Matching Funds .....	\$8,036,704
Patents Pending .....	0
Patents Issued .....	2
License Agreements .....	5
Spin-off Companies .....	1
Companies Assisted .....	172
Industry Jobs .....	46
Center Jobs .....	138

### **Cumulative**

Awards .....	\$1,000,000
Matching Funds .....	\$71,089,403
Patents Issued .....	2
License Agreements .....	60
Spin-off Companies .....	6

# Application Center for Materials Engineering

Directors, Brent Strong, Ph.D. & Paul Eastman, Ph.D., Brigham Young University, Provo, Utah  
Phone 378-7878, 378-2759, Fax 378-7575, e-mail strongb@byu.edu

## **Background**

Established in 1990 as the Advanced Composites Manufacturing and Engineering (ACME) center. It is an important resource within the state of Utah for technical knowledge and capability in the areas of plastics, composite materials and recently, metallurgy. The center assists existing and start-up companies and also conceives, invents, develops, and spins off into commercial enterprises new or enhanced products. The name of the center was changed to Application Center for Materials Engineering to expand the scope of work and to include metallurgy.

## **Technology Development Progress**

Proprietary technologies developed in the following areas:

- Cure and contamination sensing devices, which allow for low cost detection of the physical or chemical changes in non-conducting fluids, e.g. resins, oils transformer fluids etc.;
- damping of composites through unique orientation of fibers;
- improvement of fiber binding on thermoplastic composites;
- forming technique for large thermoplastic composites; and
- isotruss composite structures.

## **Highlights and Accomplishments**

Since its inception the center has assisted 160 companies, and services were provided to a total of 46 companies being launched. During the past fiscal year the center coordinated assistance to Geneva Steel in improving the quality and manufacturing productivity of products involving steel alloys.



Application Center for Materials Engineering

## **Summary Data:**

### **Current**

1995-96 Award .....	\$125,000
Matching Funds .....	\$281,098
Patents Pending .....	3
Patents Issued .....	3
License Agreements .....	2
Spin-off Companies .....	0
Companies Assisted .....	43
Industry Jobs .....	9
Center Jobs .....	n/a

### **Cumulative**

Awards .....	\$740,000
Matching Funds .....	\$5,481,728
Patents Issued .....	3
License Agreements .....	2
Spin-off Companies .....	46*

\* Services were provided to new companies being launched



# Center for Applied Molecular Genetics Selection

Director: Dr. Robert L. Park, Brigham Young University, Provo, Utah

Phone 378-6871, Fax 378-4211, email robert\_park@byu.edu

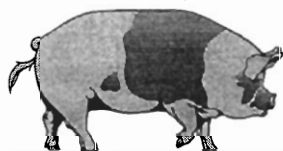
## **Background**

Established in 1995, the main focus of the center is to find specific DNA probes related to economically important qualitative and quantitative genetic traits in domesticated animals, e.g., cattle and pigs. DNA markers for traits such as back-fat thickness, feed conversion efficiency, and growth rate are of interest for swine, whereas in dairy cattle markers for annual milk and protein yield traits are being researched.

## **Technology Development Progress**

Useful DNA based probes are being developed and screened. The technologies including random amplified polymorphic DNA (RAPD), restriction fragment length polymorphisms (RFLP) and polymerase chain reaction (PCR). The objective is to identify probes that correlate with useful qualitative and or quantitative traits. The year's effort has yielded 28 promising genetic markers.

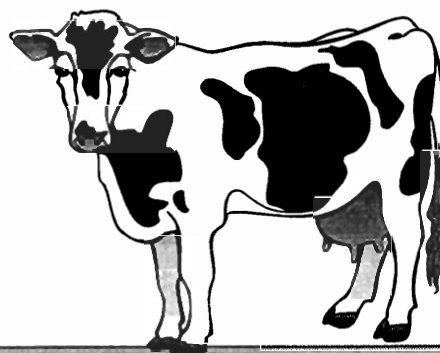
\*See newspaper article on page 46



To date, swine markers showing correlations with specific traits are: back-fat (9), feed intake (4), and growth rate (11). The search for DNA markers in dairy cattle to correlate with milk and protein yield and shoulder stature is in progress.

## **Highlights and Accomplishments**

The economic value of the DNA markers and the methods for detecting them lies in the ability to identify desirable breeding animals before they mature and produce offspring thus reducing breeding costs significantly. Contacts with key swine and cattle breeding companies are being pursued and there are early indications of significant interest when the technology has been validated. Commercialization opportunities in other areas are also under investigation.



## **Summary Data:**

### **Current**

1995-96 Award .....	\$80,000
Matching Funds .....	\$619,490
Patents Pending .....	0
Patents Issued .....	0
License Agreements .....	0
Spin-off Companies .....	0
Companies Assisted .....	6
Industry Jobs .....	0
Center Jobs .....	8

### **Cumulative**

Awards .....	\$100,000
Matching Funds .....	\$619,490
Patents Issued .....	0
License Agreements .....	0
Spin-off Companies .....	0

# Center for Computer Graphics and Scientific Visualization

Directors Riesenfeld and Cohen, Ph.D.'s, University of Utah, Salt Lake City, Utah

Phone 581-8235, Fax 581-5843, e-mail cohen@cs.utah.edu

## Background

Established in 1991 to develop integrated computer-aided solutions to problems in computer graphics, scientific visualization, computer aided geometric design and computer-aided manufacturing for industrial applications.

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*This center has successfully commercialized its technology by creating a company and has now graduated from the Centers of Excellence Program*

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## Technology Development Progress

Computer design, modeling, graphics, and manufacturing technology for automating the whole "art-to-part" process, scalable from a small job shop to a large advanced industrial shop, national televideo infrastructure and learning via the national information highway.



## Highlights and Accomplishments

**Engineering Geometry Systems (EGS) was created in Utah using center technology.** The company has released the next version (3.0) of its product. EGS has a strategic alliance for the sale of its software to Bridgeport Machines, Inc., a worldwide manufacturer of machine tools, to design and build machine tools to meet specific needs. This has resulted in an increase in employment at the company. Previously, EGS has created and delivered a custom product to Hill Air Force Base to increase its manufacturing productivity. Center technology has served as a base for this customized product. EGS has also worked with Loral Defense Systems for the creation of parts, which the company could not get designed or manufactured elsewhere.

The center is working with consultants for the application of center technology to the manufacture of a new oil drill bit. Success in this venture is expected to enhance a company's business by \$5-10 million a year. The center has also given valuable input to Governor Leavitt on various leading edge interactive televideo education methods.

## Summary Data:

### Current

1995-96 Award .....	\$100,000
Matching Funds .....	\$1,487,000
Patents Pending .....	0
Patents Issued .....	0
License Agreements .....	0
Spin-off Companies .....	0
Companies Assisted .....	5
Industry Jobs .....	15
Center Jobs .....	19

### Cumulative

Awards .....	\$500,000
Matching Funds .....	\$7,646,256
Patents Issued .....	0
License Agreements .....	1
Spin-off Companies .....	1

# Center for Dairy Foods Technology

Director, Paul A. Savello, Ph.D., Utah State University, Logan, Utah  
Phone 797-3618, Fax 797-2379, e-mail psavello@cc.usu.edu

## Background

Established in 1990 to develop new technologies to improve and develop products for the dairy foods industry.

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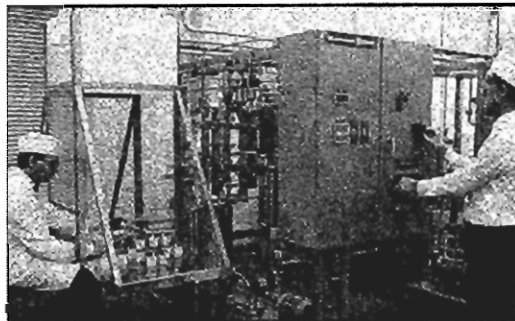
*The center has graduated this year and is actively pursuing license agreements for its patented technologies.*

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## Technology Development Progress

The center uses membrane technologies (reverse osmosis and ultrafiltration) to concentrate fluid milk at low temperatures so as not to impart any off flavors to milk concentrates.

Another technology uses ultra-high temperature heat processing to commercially sterilize milk and milk concentrates yielding new products that do not require refrigeration and can be stored for up to 12 months. The concentrated and ultra high temperature process milk can be used in reconstituted fluid milk, yogurt, ice cream and cheeses.



*Aseptic filling chamber for ultra-high temperature processing of milk.*

## Highlights and Accomplishments

A summary of current and previous accomplishments follows:

The center has signed an **option agreement** with Utah Milk Technologies, a business venture group to **pursue commercialization** of membrane-concentrated, sterile milk for export.

A **patent** for the center's "**Creamier Skim Milk**" was issued in November 1994.

- **Gossner Foods, Inc.**, Logan, holds the contract for the production and packaging of new products researched and developed by national food companies with the **assistance of the center**.
- **Heart-to-Heart Foods, Inc.**, Richmond, which produces yogurt and ice cream products and new lines of cream cheese, has used **center equipment and expertise** to research and develop new product lines for distribution in Utah.
- **International Dairy Foods Association** has shown interest in "**Creamier Skim Milk**" to increase consumer acceptability of skim milk.

## Summary Data:

### Current

1995-96 Award .....	\$52,000
Matching Funds .....	\$233,428
Patents Pending .....	1
Patents Issued .....	2
License Agreements .....	1
Spin-off Companies .....	0
Companies Assisted .....	20
Industry Jobs .....	1
Center Jobs .....	7

### Cumulative

Awards .....	\$588,562
Matching Funds .....	\$2,533,428
Patents Issued .....	2
License Agreements .....	1
Spin-off Companies .....	2

# Center for Design Systems

Director, Don R. Brown, Ph.D., University of Utah, Salt Lake City, Utah  
Phone 581-5340, Fax 585-5238, e-mail dbrown@part.net

## Background

Established in 1995, the center focuses on researching, designing, developing and commercializing software that brokers information in a time critical way for manufacturing, distribution and design companies.

---

*The center has licensed its technologies to two new spin-off companies in Utah.*

---

## Technology Development Progress

The center develops and promotes internet and intra-net based applications, for example, combining the aspects of distributed processing, database management, object-oriented programming, and fault tolerance in a system tailored towards highly diverse data and scalability to provide distributed database management to the parts manufacturing and distribution industry.



## Highlights and Accomplishments

The center has already spun-off two companies: Part.net Inc. (<http://www.part.net>) and ErgoWeb Inc. (<http://www.ergoweb.com>). PartNet is a software for electronic commerce over the Internet. The software was licensed to PartNet Inc. Suppliers list their parts in a database that they maintain on site. This database is connected to the Internet via the PartNet Vendor Database Interface software. Users submit queries to the databases through a web browser to the PartNet Client. Responses from the vendor databases are shown to the user in a tabular form containing information on the parts characteristics. PartNet has two commercial accounts and has recently received a \$3.2 million award to develop the system and deploy it in the military services. It has also received \$2.5 million in Department of Defense contracts.

ErgoWeb is a collection of World Wide Web files and programs that deal with ergonomics and safety in the workplace, which allows a user to request information about ergonomic issues, explore a library of online information, interact with tools for computing safety limits and see case studies to remedy dangerous situations. The software was licensed to ErgoWeb Inc. The company has won a \$100,000 contract from U.S. automakers.

\*See news article on page 53

## Summary Data:

### Current

1995-96 Award .....	\$100,000
Matching Funds .....	\$4,030,000
Patents Pending .....	0
Patents Issued .....	0
License Agreements .....	2
Spin-off Companies .....	2
Companies Assisted .....	6
Industry Jobs .....	11
Center Jobs .....	16

### Cumulative

Awards .....	\$100,000
Matching Funds .....	\$4,030,000
Patents Issued .....	0
License Agreements .....	2
Spin-off Companies .....	2

# Center for Developmental and Molecular Biology

Directors: Kenneth White & John Morrey, Utah State University, Logan, Utah

Phone 797-2149, Fax 797-2118, e-mail kwhite@cc.usu.edu

## **Background**

Established in 1993, one of the center objectives has been to investigate, characterize and synthesize several chemotherapeutic proteins (lytic peptides) and to develop cost-effective production methods. One of these methods involves the production of the proteins using genetically engineered animals (transgenic animals) that can secrete the proteins at high concentrations in their milk.

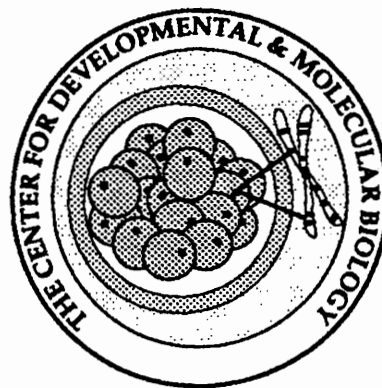
## **Technology Progress**

Technologies are being developed for the high efficiency production of valuable proteins (e.g. lytic peptides), not normally found in animal milk, by producing transgenic animals. Genes (DNA sequences) that code for the specific peptides of interest are introduced into the embryos of selected animal species which, when successful, express the desired protein in the milk producing cells or glands. The expression of the foreign protein in the milk in relatively high quantities provides a cost-effective method of producing the valuable proteins.

## **Highlights and Accomplishments**

Genes for specific peptides have been sequenced and prepared for injection into animal embryos. These genes have been successfully injected in mouse

embryos and the transgenic nature of the new born animals have been confirmed. Similar methods have been used to produce goats which, it is expected, will express the desired proteins in their milk. Expression of the proteins in transgenic goats is highly desirable because the animals produce significant quantities of milk and are relatively easy to breed and maintain. The results are pending the maturation and evaluation of the young animals.



## **Summary Data:**

### **Current**

1995-96 Award .....	\$150,000
Matching Funds .....	\$316,162
Patents Pending .....	3
Patents Issued .....	0
License Agreements .....	0
Spin-off Companies .....	0
Companies Assisted .....	2
Industry Jobs .....	0
Center Jobs .....	13

### **Cumulative**

Awards .....	\$360,880
Matching Funds .....	\$804,483
Patents Issued .....	0
License Agreements .....	0
Spin-off Companies .....	0

# Center for Electronic Systems Technology

Directors: R. Jennifer Hwu, Ph.D. & Benjamin V. Cox, Ph.D., University of Utah, Salt Lake City, Utah  
Phone 581-6954, Fax 581-5281, email hwu@ee.utah.edu

## Background

Established in 1995, this service center combines the expertise, resources, and capability of three universities: the University of Utah, Brigham Young University, and Utah State University to serve the industrial community in the area of electronic systems technology. The goal of the center is to ensure that Utah industry can compete more effectively in the global market and enhance the opportunities for Utah researchers to develop and commercialize their technologies.

## Technology Development Progress

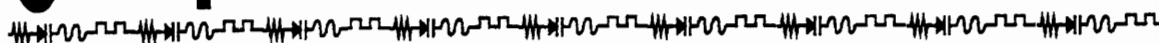
Electronic systems technologies include microelectronics, signal processing, communication and control systems, digital electronics, RF, microwave, and millimeter wave electronics, optoelectronics and electromagnetics. The center provides research, design, evaluation, and prototyping services to Utah businesses that need specialized help in developing new products or enhancing market strengths.

## Highlights and Accomplishments

- Services that are being provided to industry include access to test equipment, laboratory services, fundamental research and technology development, market analysis, personnel, information and strategic planning.
- Service contracts with a large number of technology-based companies have been signed and are in progress. Institutions that have collaborated with the center include: Loral Communications, Hodges Associates, Micron Technologies, Sandia National Laboratories, Micromanipulator, American Laser, Litton, Unisys, Digital Instruments, Alliantech Systems and National Semiconductor.
- Three new patent applications have been filed since the center was created.

# CEST

THE STATE OF UTAH CENTER OF EXCELLENCE FOR ELECTRONIC SYSTEMS TECHNOLOGY



## Summary:

### Current

1995-96 Award .....	\$150,000
Matching Funds .....	\$1,113,100
Patents Pending .....	3
Patents Issued .....	1
License Agreements .....	1
Spin-off Companies .....	1
Companies Assisted .....	12
Industry Jobs .....	4
Center Jobs .....	60

### Cumulative

Awards .....	\$160,000
Matching Funds .....	\$1,113,100
Patents Issued .....	1
License Agreements .....	1
Spin-off Companies .....	1

# Center for Industrial Imaging

Director, Robert Ehrlich, Ph.D., University of Utah, Salt Lake City, Utah  
Phone 581-5906, Fax 585-3540

## Background

This center was established in 1995 to identify markets and commercialize technologies in proven geoscience applications and other areas, e.g. ceramics, metallurgy, and medical imaging.

## Technology Development Progress

The core technology of the center is Petrographic Image Analysis (PIA), which comprises image acquisition, image processing pattern recognition/data analysis and links to physical models. Each component requires specialized hardware, software and expertise. The pattern recognition procedure within PIA has proven useful in chemical fingerprinting in a variety of geoscience/environmental applications. The center has begun to explore areas outside geoscience that have a larger economic potential, namely the medical imaging arena.



## Highlights and Accomplishments

The center is continuing in its effort to integrate its technologies into the Earth Science and Resources Institute technical programs. The center is involved in a demonstration project incorporating PIA into a multidisciplinary petroleum reservoir in Azerbaijan. This project is sponsored by a consortium of petroleum companies, which has provided a grant of \$400,000. In addition, other demonstration projects include: geochemical fingerprinting of crude oils, offshore Gulf of Mexico; chemical fingerprinting of fluid inclusions in rocks from geothermal energy study and chemical fingerprinting of groundwater data from Hill Air Force Base.

The center is exploring the application of its technologies in non-geoscience areas, e.g. medical imaging (market research is in progress). A pilot study applying the imaging technology to analysis of prostate cancer biopsy slides is also in progress.

The center has been granted the Unocal Corporation's Integrated Paleontological System Software, a petroleum industry related workstation application, for further research, development and commercialization.

## Summary Data:

### Current

1995-96 Award .....	\$100,000
Matching Funds .....	\$405,840
Patents Pending .....	0
Patents Issued .....	0
License Agreements .....	0
Spin-off Companies .....	0
Companies Assisted .....	37
Industry Jobs .....	0
Center Jobs .....	4

### Cumulative

Awards .....	\$100,000
Matching Funds .....	\$ 405,840
Patents Issued .....	0
License Agreements .....	0
Spin-off Companies .....	0

# Center for Magnetism in Information Technology

Director: C. Y. Pan, Ph.D., Utah State University, Logan, Utah

Phone 797-2857, Fax 797-2492

## Background

The center was established in 1995 to produce superior magnetic materials including permanent magnets and magneto-resistive materials, which would have applications in numerous markets including products such as motors, sensors, magnetic storage media, and electromagnetic circuitry.

## Technology Development Progress

- Permanent magnetic materials: production of high corrosion resistance rare earth materials. Efficient processing for the production of permanent magnetic materials. High temperature rare earth permanent magnetic materials.
- Magneto-resistive materials, anisotropic magnetoresistive materials and contactless sensors, readout heads for computer data storage.
- Magnetism computer aided design software.

## Highlights and Accomplishments

- An agreement has been signed between the center and a Utah company, for the company to manufacture high corrosion resistance rare-earth materials using center technology.
- The center is collaborating with the Idaho National Engineering Laboratory (INEL) to develop efficient processing for permanent magnetic materials.
- The center is also working with a Utah company to manufacture flexible magnetic materials.
- The center is working with a Utah company to develop a new type of sensor for applications in the automotive industry.



CENTER FOR MAGNETISM IN  
INFORMATION TECHNOLOGY

## Summary Data:

### Current

1995-96 Award .....	\$100,000
Matching Funds .....	415,000
Patents Pending .....	0
Patents Issued .....	0
License Agreements .....	2
Spin-off Companies .....	0
Companies Assisted .....	2
Industry Jobs .....	0
Center Jobs .....	5

### Cumulative

Awards .....	\$105,000
Matching Funds .....	\$415,000
Patents Issued .....	0
License Agreements .....	2
Spin-off Companies .....	0



# Center for Meat Processing Technology

Director, Von T. Mendenhall, Ph.D., Utah State University, Logan, Utah  
Phone 797-3463, Fax 797-2379, e-mail vonm@ext.usu.edu

## Background

Established in 1991 for the development of new meat products and processing technologies.

*The center has successfully commercialized its patented technology for the ultra-high temperature pasteurization of meat surfaces and has graduated.*

## Technologies

- Ultra-High Temperature (UHT) pasteurization of meat surfaces.



\* See newspaper article on page 52

- Low-fat lamb chops, beef steaks, pork chops, and bacon.
- Processing technology to reduce fat content of raw meat.
- Processing technology to bond meat to bone.
- Combining UHT with electron beam radiation technology to produce sterile meat products.
- UHT pasteurization combined with High-Temperature Aging (HTA) to produce tender steaks and roasts from the cheaper, less tender primal cuts of beef carcasses.

## Center Highlights and Accomplishments

- **Two license agreements** with B.V. Holland (for EEC countries and Eastern Europe) and **Agri-Products Inc.** of Woods Cross, Utah (for U.S.A., Canada & Mexico) have been signed for the use of UHT processing and marketing, creating a significant revenue stream in terms of royalties for USU.
- **A license agreement** for South America and the Pacific Rim is currently under negotiation.
- Production of UHT low-fat meat products began in Feb, 1996 at Bakker, Lekkerker, Holland (15,000lb/wk) and Feller's Pre-Cooked Meats, North Salt Lake (30,000lb/week)
- Currently USU holds **four patents** covering UHT pasteurization, bonding of meat to bone, and low-fat technology.

## Summary Data:

### Current

1995-96 Award .....	\$260,000
Matching Funds .....	\$581,930
Patents Pending .....	2
Patents Issued .....	4
License Agreements .....	2
Spin-off Companies .....	2
Companies Assisted .....	37
Industry Jobs .....	15
Center Jobs .....	19

### Cumulative

Awards .....	\$1,030,860
Matching Funds .....	\$2,415,576
Patents Issued .....	4
License Agreements .....	2
Spin-off Companies .....	2

# Center for Meat Processing Technology

## Genetic Improvement of Livestock

Director Noelle Cockett, Ph.D., Utah State University, Logan, Utah

Phone 797-3903, Fax 797-3904, e-mail fanoelle@cc.usu.edu

### Background

Established in 1991 to develop methods of genetically improving livestock through the use of DNA based genetic markers.

### Technology Development Progress

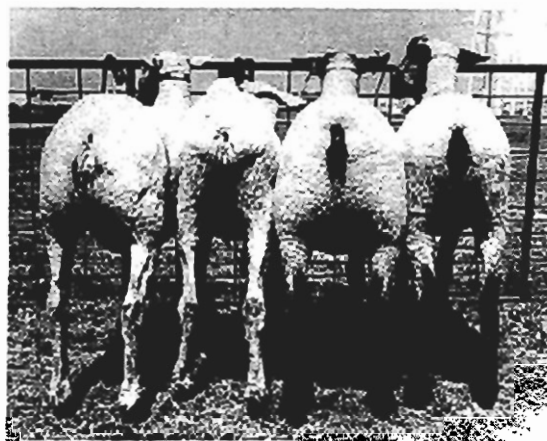
- The Center has characterized specific genetic markers that are associated with a gene that causes heavy muscling and reduced fat in sheep, the gene has been named callipyge.
- The Center has developed a test that is 97% accurate in identifying the callipyge gene; no other laboratory in the world has the available information and, therefore cannot duplicate the test.

### Highlights and Accomplishments

- The Center has determined that the callipyge gene provides an **additional \$16.06 (10.3%)** to the value of each marketed sheep. If just 25% of the sheep in Utah carried the callipyge gene, the potential added value impact to Utah would be \$1.4 million.
- Development of a **commercially-available** genetic marker test for callipyge has been initiated, with its availability being **advertised** through publications, presentations, and other means, with efforts primarily directed toward sheep producers and meat packers.

\*See newspaper article on page 49

- The differences in muscle mass in sheep **significantly affect retail yield** and the percentage of carcass weight found within the high-priced cuts.
- The U.S. Sheep Experiment Station has determined that callipyge animals require less feed for each pound of gain (another **economic advantage** of the mutation).
- Animals carrying the callipyge gene are being distributed to Utah sheep producers.
- The Center is offering a service that tests for the presence of the callipyge gene in sheep.



**Sheep carrying the callipyge trait show increased muscle mass.**

**NOTE: In fiscal year 1995-96 the Center for Genetic Improvement of Livestock was combined with the Center for Meat Processing Technology**

# Center for Minerals Technology

Director, R. Peter King, Ph.D., University of Utah, Salt Lake City, Utah  
Phone 585-3113, Fax 581-8119, e-mail rpking@mines.utah.edu

## Background

Established in 1995, the center's focus is on developing new technologies for minerals processing. Specific areas of expertise include the design of high efficiency grinding mills using state-of-the-art computer simulation software, advanced mill analysis and monitoring methods, technologies for the in-line monitoring and measurement of particle size on moving conveyor belts, and the real-time control of industrial milling processes.

## Technology Development Progress

Computer software, on-line instruments and laboratory procedures for the design, monitoring control and analysis of industrial grinding machines and operating plants have been demonstrated and are being designed for industrial applications.



## Highlights and Accomplishments

- A contract has been concluded to investigate the liberation characteristics of the copper ore at the Grasberg Mine of Freeport Indonesia
- An instrument to measure the distribution of sizes of particles on moving conveyor belts has been developed and successfully tested at an industrial site. This instrument is of great value because it eliminates the need to take samples from the conveyor for remote analysis and therefore provides real-time process control for mining and milling operations.
- The center continues to concentrate on demonstrating the application of new technologies in an industrial setting.
- The center has performed laboratory tests on samples of materials from CEMEX, Mexico, PT Freeport, Indonesia, Cypress Copper Company and Newmont Mining Co. The objective is to ascertain the applicability of the center's new test procedure for evaluating industrial ores and to promote the use of the center's experimental procedures in industry. A comprehensive market survey has been undertaken to establish the extent of interest in the equipment and procedure.

## Summary Data:

### Current

1995-96 Award .....	\$125,000
Matching Funds .....	\$670,478
Patents Pending .....	0
Patents Issued .....	0
License Agreements .....	0
Spin-off Companies .....	0
Companies Assisted .....	2
Industry Jobs .....	0
Center Jobs .....	5

### Cumulative

Awards .....	\$125,000
Matching Funds .....	\$670,478
Patents Issued .....	0
License Agreements .....	0
Spin-off Companies .....	0

# Center for MTV Flat Panel Display Technology

Director, Laurence P. Sadwick, Ph.D., University of Utah, Salt Lake City, Utah  
Phone 581-8282, Fax 581-5281

## **Background**

Established in 1995 to study new technologies to produce flat panel displays for the information (e.g., computer monitors) and entertainment (e.g., television sets) markets. The main focus is to conduct proof-of-principle research on new and emerging potential flat panel display technologies and to evaluate new and existing flat panel display technologies. An additional focus is to create and support applications needed by flat panel display manufacturers, especially those located in the State of Utah.

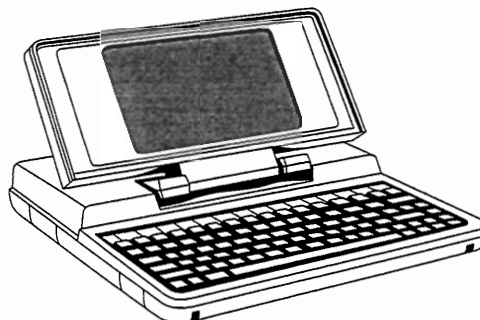
## **Technology Development Progress**

The technology and services provided by the center are in the following areas:

- Prototype development and testing of novel flat panel display technologies;
- development of high temperature electronics based on MTV electronics technology which has been created and developed at the University of Utah;
- develop tools to test and evaluate flat panel display technologies;
- work with industry (especially those located in Utah) in addressing and supporting their flat panel display technology needs;
- develop new and novel flat-panel display core technologies.

## **Highlights and Accomplishments**

Developed a new, enhanced flat panel display for which a patent application has been submitted. Established a close working relationship with a local company involved in flat panel display development. Working on a spin-off technology for high temperature electronic applications, for which several companies (including a local company in Utah) have expressed a strong interest. Have received notification Department of Energy funding to investigate another spin-off technology for micro-energy converters under a collaborative development effort with Sandia National Laboratories.



**A primary application for MTV flat panels would be laptop displays**

## **Summary Data:**

### **Current**

1995-96 Award .....	\$65,000
Matching Funds .....	\$419,655
Patents Pending .....	1
Patents Issued .....	0
License Agreements .....	0
Spin-off Companies .....	0
Companies Assisted .....	6
Industry Jobs .....	0
Center Jobs Created .....	7

### **Cumulative**

Awards .....	\$65,000
Matching Funds .....	\$ 419,655
Patents Issued .....	0
License Agreements .....	0
Spin-off Companies .....	0

# Center for Multimedia Education and Technology

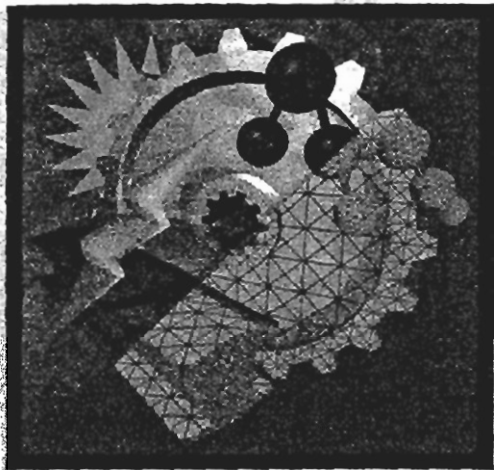
Directors: Magdy F. Iskander, Ph.D. & Richard W. Grow, Ph.D., University of Utah, Salt Lake City, Utah  
Phone 581-6944, Fax 581-5281, e-mail iskander@ee.utah.edu

## Background

Established in 1993 for the development, production, and distribution of interactive multimedia software modules for science, math, and engineering education.

## Technology Development Progress

- Software and hardware interactive multimedia products for education including simulation software, virtual laboratories, software and hardware for data acquisition and analysis, inexpensive virtual reality applications.



- Production and distribution of interactive multimedia educational modules on CD-ROM.

## Highlights and Accomplishments

- Two CD-ROM products have been developed - a multiplatform "Calculus Castle" and "Engineering Electromagnetics." Another CD-ROM in genetics, "History of the Human Gene" is also completed.
- The center manages the Conceptual Learning of Science (CoLoS), USA project, which is a consortium of eleven universities and is sponsored by Hewlett-Packard Company.
- In collaboration with John Wiley & Sons, the center continues to publish the award-winning journal, Computer Applications in Engineering Education.
- The center will be hosting an international conference "1996 Frontiers in Education" scheduled in Salt Lake City, Nov 6 - 9.

## Summary Data:

### Current

1995-96 Award .....	\$125,000
Matching Funds .....	\$534,828
Patents Pending .....	0
Copyright Issued .....	0
License Agreements .....	0
Spin-off Companies .....	0
Companies Assisted .....	10
Industry Jobs .....	0
Center Jobs .....	17

### Cumulative

Awards .....	\$350,000
Matching Funds .....	\$1,615,233
Copyright Issued .....	0
License Agreements .....	0
Spin-off Companies .....	0

# Center for Neural Interfaces

Director, Richard A. Normann, Ph.D., University of Utah, Salt Lake City, Utah  
Phone 581-8528, Fax 585-5361, e-mail normann@cc.utah.edu

## Background

Established in 1995, the center is researching arrays of micro-electrode probes designed to be inserted into the neural cortex and which provide multichannel interfacing to the central nervous system. The probes are capable of both sensing neural activity and stimulating neural responses. Ultimate human applications include artificial vision, hearing, and motor control to prosthetic devices.

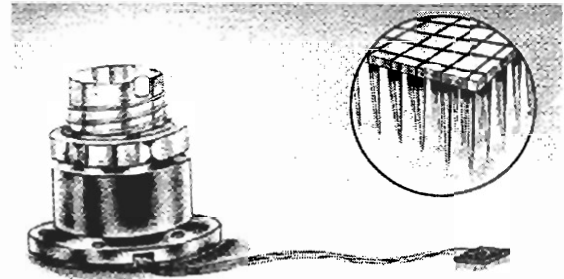
## Technology Development Progress

- The center is developing prototype probes for continuing research and is commercializing the probes for the research community.
- The center is developing methods for the insertion of the electrode arrays into the cortical tissues and associated support systems, e.g. amplifiers, electrical cabling, data acquisition software, and data analysis software.

## Highlights and Accomplishments

- Several prototypes have been assembled including an acute electrode array, a chronic electrode array, and a 16-channel amplifier system.

- A subsequent prototype has been completed that has a 25-channel neuroamplifier using high-density surface mount techniques.



- Bionic Technologies Inc. is being formed to undertake the marketing of multi-channel neural probes to be used by the research and development community. **Ultimate commercialization opportunities will include human applications in artificial vision, hearing, and prosthetic motor controls.**

\*See newspaper article on page 50

## Summary Data:

### Current

1995-96 Award .....	\$80,000
Matching Funds .....	\$243,809
Patents Pending .....	0
Patents Issued .....	2
License Agreements .....	0
Spin-off Companies .....	0
Companies Assisted .....	3
Industry Jobs .....	0
Center Jobs .....	7

### Cumulative

Awards .....	\$80,000
Matching Funds .....	\$243,809
Patents Issued .....	2
License Agreements .....	0
Spin-off Companies .....	0

# Center for Rapid Product Realization

Director, David Sorensen & Brent Strong, Brigham Young University, Provo, Utah  
Phone 378-7878, Fax 378-7575

## Background

Established in 1994 to provide manufacturing technology extension services designed to assist small manufacturing companies, to bridge the gap between new product concepts and manufacturing realization, and to develop innovative technologies which will result in products, patents, and related economic benefits for the state.

## Technology Development Progress

- Prominent technologies and capabilities include advanced computer-assisted design systems, conventional and rapid prototyping, advanced machining and fabrication technologies, state-of-the-art process definition and simulation.
- The center is coordinating the effort with other institutions in the state as they apply to new product opportunities.

## Highlights and Accomplishments

- The center was successful in obtaining a \$6,000,000 federal award over a six year period for the Utah Manufacturing Extension Partnership.
- Established a total of 3 **royalty agreements**.
- Assisted 11 companies.

\*See newspaper articles on page 48

# Rapid Product Realization

**Accelerating the Product Development Process**

## Summary Data:

### Current

1994-95 Award .....	\$200,000
Matching Funds .....	\$296,424
Patents Pending .....	2
Patents Issued .....	0
License Agreements .....	(royalties) 3
Spin-off Companies .....	1
Companies Assisted .....	11
Industry Jobs .....	3
Center Jobs .....	26

### Cumulative

Awards .....	\$400,000
Matching Funds .....	\$1,263,574
Patents Issued .....	0
License Agreements .....	(royalties) 3
Spin-off Companies .....	1

# Center for Self Organizing Intelligent Systems

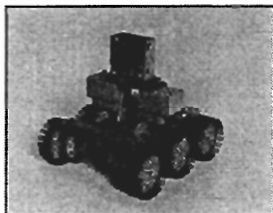
Director, Robert W. Gunderson, Ph.D., Utah State University, Logan, Utah  
Phone 797-2924, Fax 797-3054, e-mail snowvax@cc.usu.edu

## Background

Established in 1993 to assist Utah companies in developing marketable products which use the technology of intelligent systems. The center works with Utah industry to identify intelligent system solutions for new or existing commercial products

## Technology Development Progress

- Intelligent Systems Technology generally includes any device and/or software concept which attempts to artificially replicate unique cognizance and control abilities of the human mind.
- Artificial neural networks are designed to mimic the ability of the brain and central nervous system to learn and generalize from past experience.
- Fuzzy logic was introduced as a way of emulating the reasoning processes fundamental to human intelligence.
- Neuro-control emulates the sensory and communication mechanisms of the human neural system.
- The center has completed a licensing agreement with Visionary Products Inc., to produce and market the Red Rover educational project for the middle school markets in the U.S.A. and Canada



## Highlights and Accomplishments

- Products developed from center projects include: two irrigation control systems, two applications to exercise machines, autonomous micro-robotic vehicle control products, a coin recognition product, intelligent wheelchair control augmentation systems for the severely handicapped and aged.
- A vehicular sensing platform for hazardous-waste site applications and a "hands-on" Mars exploration educational kit have been developed.
- Intelligent irrigation controllers licensed to Campbell Scientific, Inc. have a projected sales volume of \$5 million a year over a seven-year period.
- Virtual presence controllers attempt to place a remote human operator or controller in a virtual environment identical to that encountered by the controlled process.
- Monetary Services, Inc., using a center-developed neural network and computer-imaging technology, estimates a minimum of 30,000 installation sites for a device to be leased for \$1,000 a month.
- ProForm Fitness Products, Inc., estimates first-year sales of exercise equipment with center developed fuzzy-belt controller and fuzzy "spotter" to be \$40 million.



## Summary Data:

### Current

1994-95 Award .....	\$150,000
Matching Funds .....	\$436,000
Patents Issued .....	0
Copyright Received .....	3
License Agreements .....	3
Spin-off Companies .....	1
Companies Assisted .....	15
Industry Jobs .....	1
Center Jobs .....	11

### Cumulative

Awards .....	\$410,000
Matching Funds .....	\$1,325,904
Patents Issued .....	2
Copyright Received .....	3
License Agreements .....	3
Spin-off Companies .....	1



# Center for 3-D Computer Graphics

Director: Eric Pedersen, Dixie College, St. George, Utah  
Phone 652-7804, Fax 628-1286, e-mail [pedersen@cc.dixie.edu](mailto:pedersen@cc.dixie.edu)

## **Background**

Established in 1991 to study the practical applications of computer graphics, specifically networking and 3-D graphics. The main focus is to conduct market research on computer graphics and networking tools and then cooperate with private industry to evaluate and create products and support services that will meet market demands.

---

*The center has graduated this year and continues to be a valuable resource for companies needing assistance in computer graphics and networking.*

---

## **Technology Development Progress**

The technology development and services provided by the center are in the following areas:

- Production of computer graphics products and provide technical support services, writing software code and licensing the source code to a company.



- Creation of computer graphics products and licensing the product to a company.
- Develop seminars, conduct product research in partnership with industry.

## **Highlights and Accomplishments**

- The center has created and/or assisted the following **spin-off companies**: Paintbrush Productions (<http://www.pbproductions.com/>), AK International, InfoWest (<http://www.infowest.com/>), NetEx, Intron, and Illustrative Impression.
- Previously, the center has signed a license agreement with Mira Imaging for \$140,000 for the center's source code in HyperSPACE Windows. The sales projection for Mira using the center source code are projected conservatively at \$1 million a year.
- The first product developed by the center during its first year is still generating about \$120 a month and represents a 15% royalty from Strata, Inc.
- The Spirit of Utah Game developed by the center is being sold through the Heritage Foundation and *St. George Magazine*.



## **Summary Data:**

### **Current**

1995-96 Award .....	\$50,000
Matching Funds .....	\$125,000
Patents Pending .....	0
Patents Issued .....	0
License Agreements .....	0
Spin-off Companies .....	2
Companies Assisted .....	110
Industry Jobs .....	13
Center Jobs .....	8

### **Cumulative**

Awards .....	\$250,000
Matching Funds .....	\$504,432
Patents Issued .....	0
License Agreements .....	5
Spin-off Companies .....	4

# Center for Value Added Seed Technology

Director, H. Grant Vest, Ph.D., Utah State University, Logan, Utah  
Phone 797-0880, Fax 797-3376, e-mail grant@agx.usu.edu

## **Background**

Established in 1991 to produce value-added crops:  
(i) drought resistant turf grasses for roadways, lawns, golf courses (require 30-40% less water),  
(ii) forage grasses with superior yield under arid land conditions, and (iii) hybrid vigor in wheat using molecular biology.

## **Technology Development Progress**

- Conventional plant breeding of forage and turf grasses collected worldwide.
- Molecular genetic markers to move genes of interest from weedy grass species into commercial forage and cereal crops.
- Plant tissue culture to clone unique agricultural, horticultural and forestry plants.
- Microbiology and plant physiology to improve methods for the genetic engineering of major crops.
- Procedures to mass clone superior crop and forestry plants and to genetically engineer cereals, cotton, and other crops.



Screening grasses in saline solution...part of breeding program to develop improved grasses for resistance to high salinity that is found along roadsides in Utah

## **Highlights and Accomplishments**

- **A unique commercial opportunity** is being pursued for the low maintenance, drought tolerant grass variety, developed at the center, for roadside plantings. Contacts through the National Roadside Vegetation Managers Association has led to establishing 15 test plots with various state Departments of Transportation, including Colorado, Idaho, Oregon, Washington, Montana, Nevada & Utah. A significant market opportunity appears to be developing.
- **Conventional plant breeding:** Breeder turfgrass seed selected for color vegetative spread, leaf width, turf quality and response to drought has been produced and distributed.
- **Molecular genetic marker technology:** The DNA based genetic markers for apomixis (asexual seed formation) genes are being used to tag apomictic Australian wheat grasses.
- **Plant tissue culture:** These show promise for use in the mass cloning and genetic engineering of agronomic, horticultural, and forestry plants.
- **Turf and forage grass cultivars** released by CFAST will be protected by the Plant Variety Protection Act. A significant number of companies as well as the United States Golf Association have expressed interest.
- **Bioreactors:** CFAST is collaborating with federal and private labs to develop bioreactors for the cloning of crops and forestry trees and to improve genetic engineering procedures.

## **Summary Data:**

### **Current**

1995-96 Award .....	\$100,000
Matching Funds .....	\$209,944
Plant Variety Protection .....	1
License Agreements .....	0
Spin-off Companies .....	0
Companies Assisted .....	0
Industry Jobs .....	0
Center Jobs .....	10

### **Cumulative**

Awards .....	\$380,000
Matching Funds .....	\$823,398
Plant Variety Protection .....	4
License Agreements .....	0
Spin-off Companies .....	0

# Center for Ventricular Assist Device

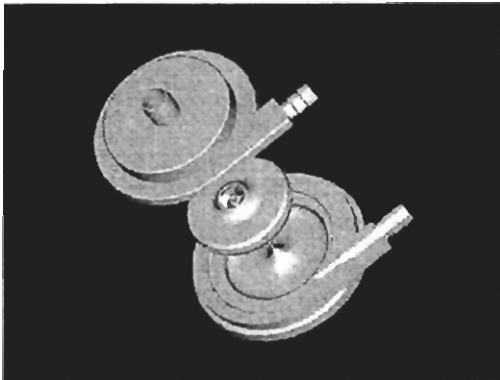
Director, Donald Olsen, Ph.D., University of Utah, Salt Lake City, Utah  
Phone 581-6991, Fax 581-4044

## Background

Established in 1995, the goals of the center are to develop a magnetically suspended centrifugal blood pump to be used as continuous-flow ventricular assist device for nearly all sizes of human patients.

## Technology Development Progress

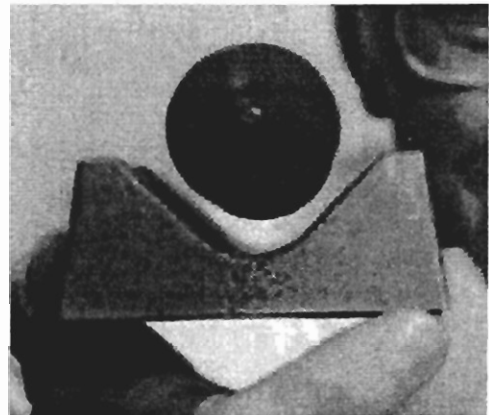
A prototype continuous flow ventricular assist device (CVAD2), which has all-electromagnetic bearings has been designed and developed. The centrifugal blood pump is gentle to the blood and is suspended in magnetic bearings. The pump output (rotor speed) is readily controlled to meet the physiologic needs of the patient. This device can pump blood over a wide range of cardiac output from 1 to 10 liters/min, effectively satisfying the physiological needs and excellent blood flow dynamics.



Prototype - continuous flow ventricular assist device 3

## Highlights and Accomplishments

The center received the Sezai Innovative Research Award at the International Society for Rotary Blood Pumps in 1995. In collaboration with the University of Virginia, a new prototype which will incorporate permanent magnet technology with further miniaturization is under development. The unique advantage of the CVAD is the absence of mechanical bearings and seals. In the long-term, these cost-effective efficient devices could be implanted in patients.



Don Olsen hopes to use a magnetic field, similar to the one that keeps the spindle in this toy suspended in air, to create an artificial heart with a pump that has no flexing parts.  
(Salt Lake Tribune Nov. 14, 1996)

## Summary Data:

### Current

1995-96 Award .....	\$100,000
Matching Funds .....	\$1,178,000
Patents Pending .....	2
Patents Issued .....	0
License Agreements .....	0
Spin-off Companies .....	0
Companies Assisted .....	2
Industry Jobs .....	0
Center Jobs .....	8

### Cumulative

Awards .....	\$100,000
Matching Funds .....	\$1,178,000
Patents Issued .....	0
License Agreements .....	0
Spin-off Companies .....	0

# Utah Centers of Excellence Program

## Planning Grant Awards

1995-96

<u>Project</u>	<u>Institution</u>	<u>Director</u>
Bioelectromagnetic Design	U/U	Dr. Om P. Gandhi
Control of Virus Infections	U/U	Dr. R. Fujinami
Fossil Resin Industry	U/U	Dr. Jan Miller
Human Genome Research	U/U	Dr. Robert Weiss
Novel Applications of Fibers	U/U	Dr. Joseph Andrade
Scientific Computing and Imaging	U/U	Dr. Christopher Johnson
Solid Oxide Fuels	U/U	Dr. Anil Virkar

\*Note: All planning grants in the amount of \$10,000

## **V. APPENDICES**

- A. Financial Summary**
- B. Economic Impact Summary**
- C. FY 1996-1997 Funded Centers**
- D. News Articles**
- E. Legislation creating the Centers of Excellence Program**

## Appendix A

### CENTERS OF EXCELLENCE - 1995/1996 FINANCIAL SUMMARY

#### CENTERS FUNDED IN FISCAL 1995/1996:

	State Funding 1995/1996	Cumulative State Funding	Fed. Match 1995/1996	Indust. Match 1995/1996	Total Match 1995/1996	Cumulative Total Match
Advanced Combustion Engineering Research - BYU	\$100,000	\$1,000,000	\$1,810,294	\$6,226,410	\$8,036,704	\$71,089,403
Application Center for Materials Engineering - BYU	\$125,000	\$740,000	\$28,000	\$253,098	\$281,098	\$5,481,728
Applied Molecular Genetics - BYU	\$80,000	\$100,000	\$34,584	\$584,906	\$619,490	\$619,490
Computer Graphics & Scientific Visualization - U/U	\$100,000	\$500,000	\$1,487,000	\$0	\$1,487,000	\$7,646,256
Dairy Foods Technology - USU	\$52,000	\$588,562	\$0	\$233,428	\$233,428	\$2,533,428
Design Systems - U/U	\$100,000	\$100,000	\$462,000	\$3,568,000	\$4,030,000	\$4,030,000
Developmental Molecular Biology - USU	\$150,000	\$360,880	\$296,162	\$20,000	\$316,162	\$804,483
Electronic Systems Technology - U/U	\$150,000	\$160,000	\$446,600	\$666,500	\$1,113,100	\$1,113,100
Industrial Imaging - U/U	\$100,000	\$100,000	\$0	\$405,840	\$405,840	\$405,840
Magnetism in Information Technology - USU	\$100,000	\$105,000	\$378,000	\$37,000	\$415,000	\$415,000
Meat Processing Technology - USU	\$260,000	\$1,030,860	\$581,930	\$0	\$581,930	\$2,415,576
Minerals Technology - U/U	\$125,000	\$125,000	\$670,478	\$0	\$670,478	\$670,478
MTV Flat Panel Display Technology - U/U	\$65,000	\$65,000	\$328,655	\$91,000	\$419,655	\$419,655
Multi-Media Education Technology - U/U	\$125,000	\$350,000	\$0	\$534,828	\$534,828	\$1,615,233
Neural Interfaces - U/U	\$80,000	\$80,000	\$29,664	\$214,145	\$243,809	\$243,809
Rapid Product Realization - BYU	\$200,000	\$400,000	\$95,899	\$200,525	\$296,424	\$1,263,574
Self-Organizing Intelligent Systems - USU	\$150,000	\$410,000	\$311,000	\$125,000	\$436,000	\$1,325,904
Three Dimensional Computer Graphics - Dixie College	\$50,000	\$250,000	\$0	\$125,000	\$125,000	\$504,432
Value-Added Seed Technology - USU	\$100,000	\$380,000	\$194,944	\$15,000	\$209,944	\$823,398
Ventricular Assist Device	\$100,000	\$100,000	\$1,178,000	\$0	\$1,178,000	\$1,178,000
<b>Subtotals:</b>	\$2,312,000	\$6,945,302	\$8,333,210	\$13,300,680	\$21,633,890	\$104,598,787

#### CENTERS NOT FUNDED IN FISCAL 1995/1996:

All Graduated Centers	\$0	\$12,302,853				\$108,562,147
All Distinguished Centers	\$0	\$4,790,440				\$67,109,942

#### TOTALS:

<b>\$2,312,000</b>	<b>\$24,038,595</b>	<b>\$8,333,210</b>	<b>\$13,300,680</b>	<b>\$21,633,890</b>	<b>\$280,270,876</b>
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1995/1996 MATCHING RATIO  
CUMULATIVE MATCHING RATIO

9.4 : 1  
11.7 : 1

## Appendix B

### CENTERS OF EXCELLENCE - 1995/1996 ECONOMIC IMPACT SUMMARY

	Center Jobs	Average Salary	Industry Jobs	Average Salary	Spin-Off Companies		Assisted Companies	Patents		Licenses
					New	Cum.		Pend.	Issued	
CENTERS FUNDED IN FISCAL 1995/1996:										
Advanced Combustion Engineering Research - BYU Application Center for Materials Engineering - BYU Applied Molecular Genetics - BYU Computer Graphics & Scientific Visualization - U/U Dairy Foods Technology - USU Design Systems - U/U Developmental Molecular Biology - USU Electronic Systems Technology - U/U Industrial Imaging - U/U Magnetism in Information Technology - USU Meat Processing Technology - USU Minerals Technology - U/U MTV Flat Panel Display Technology - U/U Multi-Media Education and Technology - U/U Neural Interfaces - U/U	138	\$26,279	46	\$55,196	1	6	172	0	2	60
	28	\$12,821	9	\$33,111	0	46	43	3	3	2
	8	\$27,313					6	0	0	0
	19	\$37,526	15	\$55,400	1	1	5	0	0	1
	7	\$30,000	1	\$20,000	0	2	20	1	2	1
	16	\$31,706	11	\$50,000	0	2	6	0	0	2
	13	\$30,923					2	3	0	0
	60	\$13,058	4	\$57,500	1	1	12	3	1	1
	4	\$52,500			0	0	37	0	0	0
	5	\$35,880			0	0	2	0	0	2
	19	\$16,286	15	\$53,400	2	2	37	2	4	2
	5	\$18,554					2	0	0	0
	7	\$24,054					6	0	0	0
	17	\$31,765					10	0	0	0
	7	\$36,148					3	0	2	0
Rapid Product Realization - BYU Self-Organizing Intelligent Systems - USU Three Dimensional Computer Graphics - Dixie College Value-Added Seed Technology - USU Ventricular Assist Device - U/U	26	\$7,923	3	\$10,000	1	1	11	2	0	3
	11	\$34,912	1	\$25,000	1	1	15	0	2	3
	8	\$25,680	13	\$21,785	2	4	110	0	0	5
	10	\$32,953					0	1	4	0
	8	\$42,938					2	2	0	0
CENTERS NOT FUNDED IN FISCAL 1995/1996:										
All Graduated Centers All Distinguished Centers	447	\$30,323	419	\$33,550	34		114	8	38	35
	149	\$27,128	478	\$35,947	16		19	5	31	27

Note: No information on industry jobs, average salary etc. is available for Centers that have not as yet spun-off companies

## Utah Centers of Excellence Program

### 1996-97 FUNDED CENTERS

For the current fiscal year (1996-97), 22 centers were funded for a total of \$2,310,000 - twelve at the University of Utah, four each at Utah State University and Brigham Young University, and two at Weber State University. Four planning grants were awarded at a total of \$40,000. The commercialization consulting program was allocated \$119,000. Following is a list of Centers of Excellence which were approved for funding for the 1996-1997 fiscal year. A report on their results and achievements will be published in the Annual Report in December 1997.

CENTER	P.I.	Inst	Contact Numbers	Brief Description
Advanced Construction Materials	Hosin Lee	U/U	(801) 585-3512 Fax (801) 585-5477 hlee@civil.utah.edu	Serves as a testing and evaluation center for construction materials and expedites the commercialization of new construction products in the marketplace.
Advanced Combustion Engineering Research	L. Douglas Smoot/ Michael King	BYU	(801) 378-6033 Fax (801) 378-6033 lds@byu.edu (801) 378-2803 Fax (801) 378-3831 mike_king@byu.edu	Develops technologies and programs designed to enhance the international competitive position of the U.S. in the clean and efficient use of fossil fuels and waste materials, particularly coal and other low-quality fuels.
Application Center for Materials Engineering	Paul Eastman	BYU	(801) 378-2759 Fax (801) 378-5037 eastmanp@byu.edu	Provides support for the development of products and processes for existing Utah companies by helping to solve material-related problems. ACME also conceives, invents, develops, and spins off new or enhanced products into commercial enterprises.
Applied Molecular Genetics	Robert Park	BYU	(801) 378-6871 Fax (801) 378-4211 robert_park@byu.edu	Provides viable opportunities for the transfer of DNA technology from research laboratories to targeted plant and animal industries to identify superior breeding stock and increase the accuracy of their selection at a much-reduced cost.
Bioremediation	D. Jack Adams/ Mohammad Sondossi	WSU	(801) 626-6058 Fax (801) 626-7445 djadams@weber.edu (801) 626-7059 Fax (801) 626-7445 msondossi@weber.edu	Focuses on the final development and commercialization of improved methods for hazardous heavy metal removal and recovery from solutions, soils, sediments.
Coal Processing Technology	Jan Miller	U/U	(801) 581-5160 Fax (801) 581-8119 jdmiller@mines.utah.edu	Proposes the development of a technology base that will lead to the development of a large fossil resin industry for central Utah, as well as advanced coal-cleaning technologies.



CENTER	P.I.	Inst	Contact Numbers	Brief Description
Developmental and Molecular Biology	Kenneth White/ John Morrey	USU	(801) 797-2149 Fax (801) 797-2118 kwhite@cc.usu.edu (801) 797-2622 Fax (801) 797-2766	Researches and develops technologies for the production of valuable proteins at sufficiently lower costs to penetrate vast new market opportunities.
Electronic Systems Technology	R. Jennifer Hwu	U/U	(801) 581-6954 Fax (801) 581-5281 hwu@ee.utah.edu	Works with industry to design and produce specific industrial-oriented electronic systems to enhance production and competitiveness. This enables industry to apply advanced university talent to industrial "real-life" problems.
Genetic Improvement of Livestock	Noelle Cockett	USU	(801) 797-3903 Fax (801) 797-3904 fanoelle@cc.usu.edu	Developing a commercial genetic-marker testing laboratory. One of the tests that is currently available is for a gene called "callipyge" that causes heavy muscling and a reduction of fat in sheep. Increased muscle mass significantly improves the value of sheep.
Industrial Imaging	Robert Ehrlich	U/U	(801) 581-5906 Fax (801) 585-3540 behrlich@esrilan.esri.utah.edu	Working on the application and commercialization of a series of image analytical algorithms within a variety of industrial fields, particularly environmental assessment, medical imaging, financial applications, and materials science.
Intelligent Interactive Visual Imaging Technology	Bill Barrett	BYU	(801) 378-7430 Fax (801) 378-7775 barrett@cs.byu.edu	Proposes to develop the use of intelligent computer tools for digital image composition, digital library creation, and creation of an interaction with virtual environments.
Minerals Technology	Peter King	U/U	(801) 585-3113 Fax (801) 581-8119 rpking@mines.utah.edu	Developing technologies in comminution, or size reduction, used to extract minerals from mineral ores to produce aggregates for the construction industry, fine powders for manufacturing, and pulverized fuel for electric power generation.
MTV Flat Panel	Larry Sadwick	U/U	(801) 581-8282 Fax (801) 581-5281 sadwick@ee.utah.edu	Researching a patented and patent-pending technology to make low-cost, high-yield microminiature thermionic vacuum emitters that can be individually addressed to collectively perform the function of cathode ray tubes and matrix liquid crystal displays.
Multimedia Education and Technology	Magdy Iskander	U/U	(801) 581-6944 Fax (801) 581-5281 iskander@ee.utah.edu	Develops and commercializes interactive multimedia CD-ROM products for education and implements research and development to examine the feasibility of using virtual reality technology in education and corporate training.

CENTER	P.I.	Inst	Contact Numbers	Brief Description
Neural Interfaces	Richard Normann	U/U	(801) 581-7645 Fax (801) 581-8966 normann@cc.utah.edu	Developing neuroprosthetic systems that will provide the restoration of limited sensation to the profoundly blind or deaf or to provide enhanced interaction of quadriplegics with their environment.
Raman Technology	Robert Benner	U/U	(801) 581-6684 Fax (801) 581-6684 benner@ee.utah.edu	Proposes to commercialize Raman technology for chemical monitoring in industrial processes and medical applications. It can be used as a general-purpose analytical technique for measuring the chemicals in solid, liquid, or gaseous samples.
Scientific Computing and Imaging	Christopher Johnson	U/U	(801) 581-7705 Fax (801) 581-5843 crj@cs.utah.edu	Proposes to make available through software licenses and contracts the SCIRun Software System, a visually-based programming environment that allows the interactive construction, manipulation, and visualization of scientific and engineering simulations.
Self-Organizing Intelligent Systems	Robert Gunderson	USU	(801) 797-2924 Fax (801) 797-3054 snowvax@cc.usu.edu	Helps Utah industry develop marketable products using the technology of self-organizing intelligent systems and to establish itself as a world leader in intelligent systems research.
Solid Oxide Fuel Cell	Anil Virkar	U/U	(801) 581-5396 Fax (801) 581-4816 anil.virkar@m.cc.utah.edu	Researches electrochemical devices which can convert chemical-free energy of combustion of a fuel, such as natural gas or hydrogen, directly into electricity at very high efficiencies.
Solvent Separation of Heavy Oils	Park Guymon	WSU	(801) 626-6953 Fax (801) 626-7445 eguymon@weber.edu	Developing a unique cold solvent/surfactant technology so that heavy oils can be separated more rapidly, without heat, with minimal environmental damage, lower cost, and enabling the heavy oil to be recovered for commercial uses.
Utah Genome Technologies	Robert Weiss	U/U	(801) 585-3435 Fax (801) 585-7177 bob.weiss@genetics.utah.edu	Develops technology for large-scale DNA sequencing and to complete the determination of sequences of human and a number of model organisms. Its broad application will be to reveal the patterns of inheritance in families.
Value-added Seed Technology	H. Grant Vest	USU	(801) 797-0880 Fax (801) 797-3376 grant@agx.usu.edu	Develops technologies and value-added crops and turf grasses to be marketed for the economic development of Utah-based agricultural and recreational industries.

The Salt Lake Tribune  
March 25, 1996

## Bigger Lamb Rumps May Mean a Better Bottom Line

By Hilary Groutage  
THE SALT LAKE TRIBUNE

For six years, Noelle Cockett and other researchers at Utah State University have dreamed of counting sheep with bigger, leaner, well, derrieres. That's callipyge if you're speaking in French (or in public).

"Yes. I came up with the name," Cockett said. "We wanted something novel and because we were the ones to identify the genetic region, I guess it gave us the ability to assign it a name. Now it's on the sheep map. There it is, callipyge."

In French, the word means "beautiful buttocks." In the sheep business, it could mean big money. Callipyge (callow-peej) animals have about 30 percent more flesh in their hind ends, right where the choice cuts are taken.

"A bigger hind quarter means more profit for lamb producers and that's wonderful," said Vic Saunders, spokesman for the Utah Farm Bureau.

Saunders said lamb has the reputation for being a rich, greasy meat. Growing a leaner version could be a boon.

The mutated gene was discovered on a farm in Oklahoma in a ram who later was named "Solid Gold." Every callipyge is a descendant of the Oklahoma animal.

Cockett got involved when a friend started the first herd in Texas in the 1990s and she received a grant from the Utah Centers of Excellence to find the genetic marker for

■ See LAMBS, Page D-5

## Lambs Yielding Choicer Cuts

■ Continued from D-1

the trait. The samples were delivered in 1992 and the marker was identified in 1993 in Cockett's molecular genetics lab at USU.

"Our own angle is the genetics and how it's inherited," she said.

At some point, the genetic wizardry has to be available to ranchers who will use it to increase profits.

"It can be pleasing to the eye and look lean, but nothing is worse than buying a piece of meat that doesn't taste good," said Loren Moench Jr., vice president of the American Sheep Growers Association. "If people have a bad experience, studies have shown a bad experience with lamb affects 200 people by word of mouth."

Moench's concern for taste has not gone unnoticed in the genetics lab. There is just one problem with callipyge meat. When it is slapped on the grill in the form of a lamb chop, it can come off resembling shoe leather.

"I like to call it a tenderness problem," Cockett said, but it is far from unfixable. Roasted as a rack, leg or loin, the problem disappears, and the meat tastes fine. By the end of the year, Cockett and her team will have figured out a way to tenderize the chops during the packing process.

"The industry wants a very good product and we've taken it upon ourselves to make a very good product," she said.

Department of Agriculture statistics show Utah's sheep industry was valued at more than \$37 million last year. With meat processing and retail sales figured in, the number jumps to \$80 million. But Moensch said that's a fraction of what it used to be and the research may offer a much-needed boost.

"I would say that I am cautiously optimistic," he said.

Consumers in Logan must be more hopeful. When USU employees were offered callipyge meat at \$1.50 per pound, all but three of the lambs were sold by mid-month.

As for Cockett, she does her part to support the industry.

"I cooked some last night in fajitas. It tasted great. I had to tell my husband it was lamb," she said.

## DNA MARKERS

# A lean gene? Project at BYU is on the scene

Scientists say research ultimately will lead to lower-fat pork products.

professor of botany and range science.

Andersen is one of three principal researchers for the project. Robert Park and Richard Thwaites, both BYU animal science professors, are also major players in the study.

"We're really looking at lower back fats in animals, and the pork chop muscle in pigs," Park said. Leaner cuts of ham are also part of the research.

"The bottom line is that people really don't want as much fat in the meat they eat, and the research is focusing on pigs. We've identified five genetic markers for the low back fat in pigs, and we're looking at turkeys, too," Park said.

Please see **DNA** on B2

By Mark L. Reese

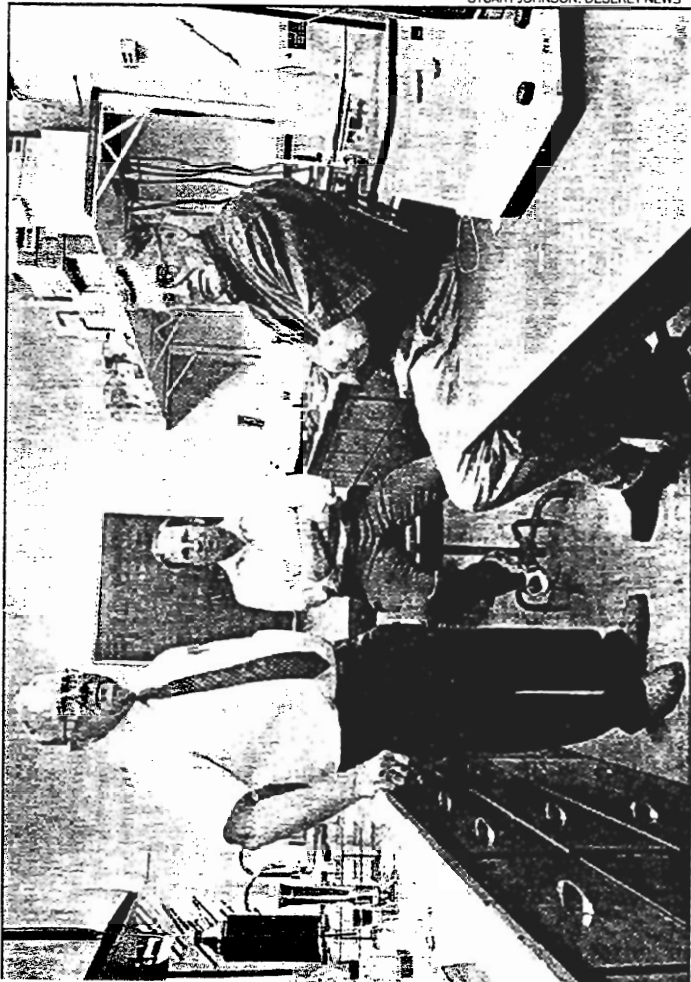
Deseret News staff writer

PROVO — The "other white meat" could be even better for you, a Brigham Young University project aims to prove.

Through the efforts of a team of scientists who are mapping genetic DNA markers in animals and plants, the research will ultimately enable hog breeders to produce leaner pork products.

"We're trying to develop commercial genetic probes for economically viable traits in cows and pigs," said Ralph Andersen, a

STUART JOHNSON, DESERET NEWS



Park, Richard Thwaites and Ralph Andersen are the principal researchers on the DNA project.

## DNA

Continued from B1

Increased milk production in dairy cows is another component of the study, as the genetic testing will be used in finding similar economically important markers in livestock.

According to the researchers, gene mapping is critical because of the abundance of DNA material and the relative scarcity of specifically identified genes.

Park said identifying exact genes within the genome is extremely difficult, but the BYU team can identify markers that are useful because of where they are located to an important gene — such as the gene that produces low back fat in pigs.

"We're really looking for fragments, just trying to get close to the genes," Park added.

Because of DNA's complexity, approximately 20 different markers could be needed to identify one physical trait.

Although the study on animals is the most integral portion of the study, Andersen said perhaps the greatest potential of the research may lie in the agricultural arena of crop yields and harvesting.

Andersen, who helped develop the procedure for mapping genes while on a BYU sabbatical at DuPont in 1989, explained potential uses of the genetic study for crops.

"At DuPont, the purpose was to produce DNA markers and a genetic map for corn," he said.

"Since I had my finger in the research, we brought it here where we're using it to tag important genes with an associate DNA marker. We call it marker-assisted selection.

"We're using the same principle in plants as we are for animals. We're investigating the development of a hull-less oat. And we're also trying to identify a disease-resistant tomato."

Andersen said the team of researchers will identify the economically important genes, tag them, track them, isolate them and sequence them.

Park said most of the research would primarily benefit national companies and industries, but the

BYU team is also thinking about how their work could affect the state.

"In Utah, we're considering working on hay; that is, a high-protein-content hay," Andersen said. "Also, we're trying to help the mining industry in the development of a desert bush to help reclaim disturbed soils. It's not weedy, it's palatable, grows well and can be used as a recovery plant."

He added the project might also be interested in opportunities in the potato industry, looking for specific traits of different carbohydrate levels in the vegetable.

"Advantages in this study are tremendous in the area of plant or animal development. It will shorten the time of cross-breeding initiation to final objective.

"In this manner, you can fingerprint the parent and make sure the progeny carry markers, eliminating the task of back-crossing several generations to fix undesirable traits," Andersen said.

The team of researchers recently received an \$80,000 Utah Centers of Excellence grant for the genetic work.

Park said at least two graduate students are working on the project, and he hopes to get as many as four. Five undergraduates are also working with the genetic mapping research.

"The process we are using with students is to provide a precise teaching experience," Park said. "The students are pretty excited about it."

"This provides a wonderful opportunity for students' careers," Andersen added. "It's excellent hands-on work."

Other BYU faculty members working on the project include: Daniel Fairbanks, professor in botany and range science; Paul Evans, professor in zoology; Mikel Stevens, professor in agronomy and horticulture; Farrel Jensen, chairman of the department of economics; and William L. Park, associate dean, College of Biology and Agriculture.

Andersen said other major sites around the country doing similar genetic research include the University of Georgia, Cornell University, the University of Wisconsin and the University of California.

## Myriad Genetics Shares Rise

Myriad Genetics Inc. shares rose Friday after researchers said a gene the company is developing to combat inherited breast cancer also may be used to treat more common, nonhereditary forms of the disease.

The study, published in Friday's issue of *Science* magazine, was conducted by researchers at the University of Texas.

Myriad shares closed at 33 a share Friday, up 5½ from Thursday's close of 27¾.

Shares in Myriad began trading on Oct. 6, when the Salt Lake City-based company sold 2.6 million shares at \$18 each to raise \$47 million.

The gene, known as BRCA1, is believed to play a role in the development of inherited forms of breast and ovarian cancer, said Myriad President and Chief Executive Peter Meldrum.

Myriad and a team of researchers, including some from the University of Utah, said they discovered the gene in September 1994. Myriad has filed a patent application for the gene.

Once the company identifies genes associated with disorders such as cancer, cardiovascular disease, obesity, osteoporosis and asthma, it will develop products and services to treat the disease.

Meldrum said Myriad is now at the point where it is working on developing a test to identify the mutations in the BRCA1 gene.

Since the inherited forms of breast cancer account for only about 10% of breast cancer cases, the discovery by researchers at the University of Texas could represent a much larger market for the company's test.

## **UTAH PROGRAM**

# **Partnership helps small businesses**

The state's Centers of Excellence have formed a partnership with Rapid Product Realization Center at Brigham Young University to establish the Utah Manufacturing Extension Program that will be a key item in the Utah Business Resource Centers, formerly known as the Utah Small Business Development Centers.

The partnership will be funded for six years by a \$5.8 million grant from the U.S. Department of Commerce's National Institute of Standards and Technology. The Utah Department of Community and Economic Development will contribute \$100,000.

UMEP is a statewide network organized to enhance the productivity and technological performance of more than 2,700 small and medium-size manufacturers. Manufacturing accounts for 15 percent or \$5.1 billion of the state's gross product.

UMEP will provide seven full and/or part-time field engineers who will be located at the Utah Business Resource Centers at all public higher education facilities.

These field engineers will be the primary contact with industry and will assist in resolving near-term problems. Major projects will be referred to UMEP's project engineers who will utilize a spectrum of resources and services to support the program.

## **Network Is Formed To Aid Manufacturers**

Utah's Centers of Excellence has formed a partnership with the Rapid Product Realization Center at Brigham Young University, funded by a \$5.8 million federal grant from the Commerce Department.

The Utah Department of Community and Economic Development also will contribute \$100,000 in helping establish the Utah Manufacturing Extension Program (UMEP), considered a key element in the Utah Business Resource Centers.

UMEP is a network designed to enhance the productivity and technological performance of more than 2,700 small and medium-sized manufacturers.

## **Highland man gets state help on roof brackets**

HIGHLAND. Utah County — Although it hasn't snowed much this fall, a Highland company, assisted by the state's Centers of Excellence program, hopes its new product will help prevent property damage, injuries and even death caused by falling snow.

Terry Anderson of TRA Inc. has developed snow brackets that can be installed on all types of roofs to prevent chunks of snow and ice from falling off. About 500 of the spikes are needed for the average house.

Anderson saw similar devices in the Alps and other parts of Europe and invented his own version. He went to the Center for Rapid Product Realization at Brigham Young University, where director David Sorensen and his staff refined the bracket and tested its effectiveness.

As a result of the tests, the brackets are being installed on a growing number of residential, commercial and church buildings. TRA has sold 11,000 brackets so far, manufactured by an Ogden company.





The first and third sheep, from left, have developed big butts because of a mutant gene inherited only from the male, researchers at Utah State University have discovered.

## USU Researchers Hope Their Work Can Lead to More Marketable Sheep

BY LEE SIEGEL

THE SALT LAKE TRIBUNE

Utah State University researchers have solved a mystery: why some sheep with the "beautiful buttocks" gene develop hefty hindquarters, yet others have only petite posteriors.

The discovery should help livestock producers raise lambs with less fat and up to 30% more meat in their buttocks. It also might help explain strange patterns by which some human diseases are inherited.

The study was published Friday in the journal *Science* by molecular geneticist Noelle Cockett and colleagues at USU, Texas Tech University in Lubbock, the University of Liege in Belgium and the U.S. Sheep Experiment Station in Dubois, Idaho.

The sheep carry a trait named callipyge, which was discovered in 1983 in an Oklahoma ram that had "muscular hypertrophy" — scientific jargon for big, meaty buttocks. Ten years later, Cockett and colleagues discovered the mutant gene responsible for the trait was located on sheep chromosome 18. The gene also was named callipyge, which is Greek for beautiful buttocks. Cockett uses French pronunciation: cal-leh-peej.

Scientists initially assumed the trait was inherited in a conventional or Mendelian manner, namely, that lambs would have

big buttocks if they inherited the callipyge gene from either the ram, the ewe or both. But lamb producers complained they were getting too few lambs with big backsides.

Cockett and other researchers did a series of breeding experiments in which they tried to produce lambs with large buttocks. They also discovered a genetic "marker" that reveals which sheep actually inherited the callipyge gene, and they tested blood from the sheep for that marker.

The experiment revealed an unusual inheritance pattern for the callipyge gene and the big-buttocks trait. If both the mother and father passed on the gene, or if just the mother did, the lambs also carried the gene but didn't have big buttocks. Lambs developed big buttocks only if the father passed on the mutant gene and the mother didn't.

"If the gene comes from the mother, it is turned off in her offspring, regardless of what dad passes on," said Cockett, a professor of animal science. "We've clarified the inheritance of the big-butt trait so producers can get all the big-butt lambs they want," simply by mating rams that carry the callipyge gene with ewes that lack it.

Producers can identify callipyge rams even if they don't have large buttocks by having their blood tested to see if the genetic

marker is present. Producers are eager to breed lambs with large buttocks if researchers can overcome a problem: the meat tends to be tough. Cockett, however, is confident meat-aging and processing methods can produce tender meat from callipyge lambs.

Aside from its practical implications, Cockett said her study is important scientifically because "it's a novel genetic inheritance pattern" called polar overdominance. It previously had been observed only in one species: mice with a mutation that makes them die before birth, but only if they inherit the mutant gene from the mother and not from the father.

Similar odd inheritance patterns might explain why some human diseases seem to be complex, multi-gene diseases when, in fact, they are caused by a single mutant gene, Cockett said.

Carmen Sapienza, a geneticist at Temple University Medical School in Philadelphia, said one such possibility is Beckwith-Wiedemann syndrome, which produces large babies with a high risk of childhood cancer. It almost always is inherited from mothers rather than fathers with the mutant gene.

Cockett and colleagues are trying to discover the exact location of the callipyge gene. Animal scientists hope it might be transferred into pigs and cattle to give them meatier rumps.

## **RESTORING SIGHT**

# Artificial Vision May Be More Than Sci-Fi in 10 Years

BY LEE SIEGEL

THE SALT LAKE TRIBUNE

The once-distant dream of restoring limited vision to blind people may be a reality in 10 years.

Developers of artificial-vision devices made that prediction Tuesday in Salt Lake City as they outlined efforts to convert images from eyeglass-mounted TV cameras into signals fed either to the retina or to the brain's visual cortex.

"We're not talking about vision like normally sighted individuals enjoy," but crude tunnel vision to let blind people read and get around, said Richard Normann, bioengineering chairman at the University of Utah.

Development of artificial-vision devices for the blind "is not a sure thing" because of technical obstacles, said Normann, who organized the symposium at the meeting of the Rehabilitation Engineering and Assistive Technology Society of North America.

Normann and colleagues developed arrays of up to 625 electrodes that would be implanted in the brain as a key component of artificial-vision or hearing devices. They implanted them in cats and monkeys, showing the devices are safe and can stimulate sensory perception in the brain.

### **Tiny Cameras, Computer Chips:**

Harvard University ophthalmologist Joseph Rizzo described how he is developing a device that might restore rudimentary vision to people with retina damage caused by retinitis pigmentosa or macular degeneration, the most common cause of blindness in the elderly.

A tiny camera would be mounted on eyeglasses worn by a blind person. The image would be converted into an invisible laser beam aimed at a computer-chip device implanted on the retina. The chip would convert visual imagery in the beam into electric signals to stimulate the retina to allow partial vision.

Rizzo said it will be at least five years before the device is tested in humans. Last week, he used a prototype implanted on a rabbit's retina to show strong visual signals reached the animal's brain.

Such an approach will work only for blind people who have functioning optic nerves. A battery-operated device to restore crude vision to diabetics and others with optic-nerve damage is being developed under the direction of Terry Hambrecht, head of neuroprosthetics at the National Institutes of Health.

Hambrecht's approach also uses a TV camera mounted on eyeglasses. But the signals are fed to electrodes implanted directly into the visual cortex.

A 42-year-old blind woman wore 38 surgically implanted electrodes for four months during 1991 and 1992. When electric currents were applied to the wires, 34 of the electrodes worked, letting her "see" 34 dots of light — crude vision in which images resemble dots of light on a stadium scoreboard.

**Human Testing:** Within a year, Hambrecht hopes to implant 256 electrodes in the brain of another patient to provide more complex images. He and Normann agreed it would be 10 years before artificial-vision devices are on the market.

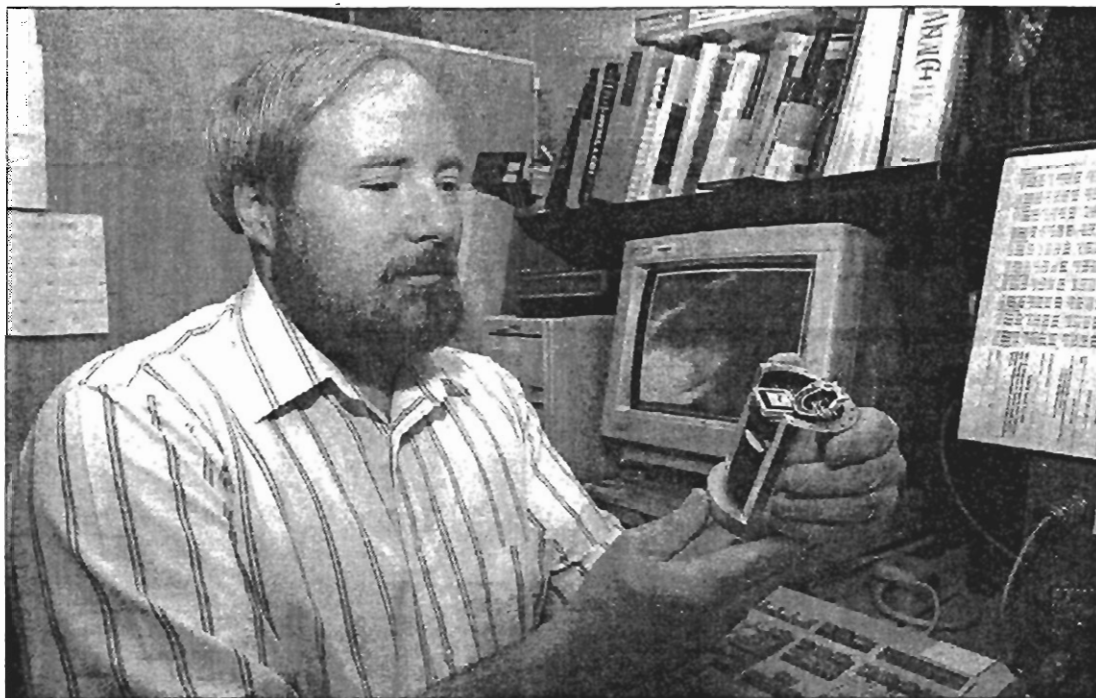
At the U., Normann and Ken Horch used a vision simulator to show that only 625 dots, or pixels, of visual information sent to the brain can provide useful vision to a blind person. In people with normal sight, 1 million optic-nerve fibers carry an image to the brain.

Six students donned ski goggles equipped with a small TV camera, which sent the pictures to TV monitors right in front of the eyes. Pieces of foil with varying numbers of holes were placed over the monitors. With 625 holes, the students could read text two-thirds as fast as normal and negotiate a maze with the same skill as a sighted person.

Columbia University ophthalmologist Peter Gouras and Swedish researchers transplanted epithelial cells from aborted fetuses into the retinas of 14 older people with macular degeneration.

The transplanted cells are meant to prevent macular-degeneration patients from progressing to profound blindness. The U.'s Horst von Recum is developing a method of producing single layers of such cells for transplant, mimicking the monolayer normally found in the retina.





John Shupe

Jay Smith holds a satellite piece the Center for Aerospace Technology made from a jet part.

## Ogden Satellite Company Takes Flight

BY LISA CARRICABURU  
THE SALT LAKE TRIBUNE

OGDEN — The Center for Aerospace Technology has given birth to a satellite-products company that is the first private enterprise to spin off from research at Weber State University.

One Stop Satellite Solutions will license inexpensive small-satellite technology developed by CAST as part of WSU's undergraduate engineering technology program, said Jay Smith, CAST associate director.

It will manufacture and market small-satellite products to cellular telephone companies, research firms and other commercial enterprises looking for cheaper ways to take advantage of space technology.

Smith said OSSS will incorporate in June. It initially will lease space from WSU.

"It's a good opportunity for WSU to help northern Utah develop its economic base a little more broadly," said Lee Carrillo, director of the WSU Office of Grants and Contracts.

CAST has its roots in a 1978 project in which a group of students, professors and Ogden-area engineers built a small satellite to map high-altitude radar characteristics for the Federal Aviation Admin-

istration. Since then, the center has involved students in the design and manufacture of 11 other small satellites.

For the past five years, CAST has received Centers for Excellence matching funds from the Utah Department of Community and Economic Development. The Centers for Excellence program is designed to stimulate economic development by helping researchers market technological advances.

It was through the program that state consultant Dale Richards helped CAST recognize that its technology could be commercialized, Carrillo said.

Richards now is OSSS chief executive officer. As such, he is developing marketing strategies and building the company's core business.

Eventually, OSSS will be weaned from state assistance.

Smith and Richards said CAST's best discriminator is its inexpensive products.

Much of the technology it uses was developed by others. Where CAST has made strides is in doing the same things at lower costs.

Smith said CAST has had a small budget since its inception, forcing it to develop less expensive ways

of manufacturing satellite components that are as effective as more costly alternatives.

For example, rather than pay \$80,000 each for torque reaction wheels that rotate satellites to position them correctly, CAST found surplus F-4 Phantom fighter jet parts that it re-engineered to perform the task. The cost for each is about \$20,000.

Other CAST-developed components that OSSS will market include flight computers, space frames, battery packs and sun sensors.

Smith said OSSS will be able to build complete satellites for companies at a cost that is 10 to 20 times lower than the \$50 million it typically costs.

"What we invented are ways to do this faster, smaller and cheaper. We've been doing it that way for a number of years," he said.

Carrillo said about 25 researchers and others who have had a stake in CAST bought stock to provide the capital to start OSSS. The company will contract with CAST for research and development services, paying royalties back to the university for new ideas that are developed.

The arrangement will allow WSU to maintain the student engineering-lab experience for which CAST is known while also serving the needs of a local company.

Smith said CAST last week learned a project it is undertaking with the University of New Hampshire received a \$4 million NASA grant. CAST will receive \$1 million of that to build the satellite that will carry a UNH experiment on gamma ray bursters to space.

Smith hopes CAST will subcontract with OSSS for much of that work, getting the new company rolling.

Richards said market response to what OSSS has to offer so far has been good.

"There is incredible synergy between the resources of the university and the needs of the market in this case," he said. "It's a situation where everyone wins."

USU  
develops a  
lean, mean  
processing  
machine  
that makes  
food easier  
to swallow



Utah State University food scientist Von Mendenhall holds a 3.5-ounce piece of beef that has only 5 grams of fat thanks to the USU Department of Nutrition and Food Science's newly developed processing method.

# Meat fat takes a tumble

By VALERIE PHILLIPS  
Standard-Examiner staff

**L**OGAN — Food scientist Von Mendenhall likes to take on the more meaty issues of life. At Utah State University's Department of Nutrition and Food Science, he sinks his teeth into ideas like making bacteria-free beef, low-fat pork chops and turkey jerky.

It's all part of helping Utah's meat industry save money and meet consumer demand, which in turn makes a big impact on the state's economy, says Mendenhall, the state USU Extension meat specialist and director of the USU's Center for Meat Processing.

"The Olympics would be nice for a year, but it won't bring in what the animal industry brings in," Mendenhall said.

Some of the department's ideas are ahead of their time, and some have been outright flops.

For instance, when researchers created a bacon made from turkey in 1975, few people were concerned enough about fat content to buy it. Now, in the wake of today's fat phobia, turkey bacon sales are soaring.

Also back in the '70s, the department invented the "hop dog" as a way to use rabbit meat. The idea of serving the Easter Bunny with mustard and relish didn't fly. And a few years ago, when researchers conducted blind taste tests, horse meat steaks received scores of 7 to 8 points out of 10. Still, Utahns aren't trotting out to buy them.

## Safe beef

But other projects appear to be right on target. Because recent food poisoning scares have caused consumers to look twice at their fast-food hamburger, a way to pasteurize meat to kill harmful bacteria seems to be an idea with a future.

"With whole pieces of meat from a healthy animal, the inside is sterile," says Mendenhall. It's the outside that comes into contact with bacteria.

"When you cook a slice of beef, the outside gets up to 212 degrees, which kills any pathogens on the surface," he said. "So, it can be rare on the inside and you're still safe. But when you grind up meat and the outside ends up inside, that's what puts you at risk."

The challenge for researchers: finding a temperature high enough to kill the bacteria without cooking the meat on the inside. Initially, he said, they used a temperature of 1,500 degrees

**'We have developed a machine that "massages" the cuts of meat in a tumbling process like your clothes dryer. You force the fat out of the meat and it sticks to the surface of the tumbler.'**

**— Von Mendenhall, USU food scientist**

steel.

"We brought it out and it was black on the surface," he said. "We knew the pathogens obviously were dead, but nobody wanted to eat the roast."

They reduced the temperature to 2,100 degrees Fahrenheit for 20 seconds, and the meat came out looking oven-roasted on the outside with a raw center. When stored in a carbon-dioxide-filled package to keep it pathogen-free, it has a refrigerator shelf-life of six months, and "the longer it sits in your refrigerator, the more tender it gets."

After a 12-minute zapping in the microwave, you've got a roast that normally takes all afternoon in the oven. A pasteurized steak takes one minute and 20 seconds of microwave time.

## Costs, marketing

Ultra-high temperature pasteurization costs about 4 cents per roast, Mendenhall said, and it works on lamb, pork and fish, too.

"It's designed for convenience, because you can pick it up at the store, take it home and put it on your table," Mendenhall said. "And you don't have to send your kids to home ec school to learn how to cook; they just push the button on the microwave and it's done."

The pasteurization process has been patented — and Bill Berge, who oversees the patenting process on behalf of USU and negotiates licensing agreements with food manufacturers, said a European company is now licensed to use it on

Canadian food manufacturers are ongoing, he said.

"I'm not rich yet, but we have a license agreement with a company in Europe that will produce these products for (European) countries," he said. "We're hoping to license it in the U.S. and Canada."

## Where's the fat?

Low-fat meat is another on-target idea for today's food market.

Actually, contends Mendenhall, red meat isn't that much higher in fat than poultry and fish — it just contains less water.

"Meat has suffered because we compare nutritional information on a raw basis, and nobody eats meat raw," he said. "Most red meats are 60 percent water and 40 percent solids. Chicken is 70 percent water and 30 percent solids, and fish is 80 percent water and 20 percent solids."

It's not hard to make a low-fat meat product, but it is difficult to make it tender and juicy, he said.

"We have developed a machine that 'massages' the cuts of meat in a tumbling process like your clothes dryer," he said. "You force the fat out of the meat and it sticks to the surface of the tumbler."

The fat is replaced with water. The meat is then pasteurized, treated with charcoal-flavored "grill marks" and packaged under oxygen-free conditions to preserve the color and flavor.

The resulting "Quickgrill" steak is 3 percent fat rather than the usual 30 percent, he said, but the fat percentage of the meat can be tailored to the buyer's specifications.

The same European country licensed to use the pasteurization process is also planning to produce the low-fat meats, Berge said. While some American fast-food chains have expressed interest in the possibility of a low-fat steak sandwich, none have actually bitten into it.

## Other meats, other markets

The method is also used to make low-fat Canadian bacon, which can be used to top pizzas with low-fat mozzarella cheese also developed at Utah State University.

A low-fat pork was made the same way and flavored with sausage seasoning.

"We took these down to Logan Regional Hospital and the doctors thought they were wonderful for heart patients sick of eating chicken," he said.

Lamb can also be similarly treated, but when the

# Meat

From 10 fat content goes 6 percent or lower, the lamb-y flavor is gone, Mendenhall says.

These made-to-order meats are a boon to food-service industries: "If every steak weighs exactly the same, their calculations on price can be very precise," Mendenhall said.

Airlines are another likely market for the low-fat, pasteurized meat. But first researchers had to correct a problem: The steak was so juicy it leaked all over in the neighboring mashed potatoes. They added a starch that gels at 120 degrees, and substituted teriyaki flavoring for part of the water. Rice was used as the side dish, and "the meat then made a nice sauce for the rice," Mendenhall said.

Healthy snack foods pose yet another possibility: "Stew-on-a-Stick" is a beef-vegetable combination that's dried into jerky. A vegetarian version has also been developed. Berge says he's talking to an interested food manufacturer, and he predicts this product could be on the market by the end of the year.

## Talking turkey

Twenty years ago, long before America's fear of fat became an epidemic, Utah's turkey farmers and processors were looking for ways to sell turkeys other than in the form of whole roasters and a limited quantity of turkey breasts.

The USU Department of Nutrition and Food Sciences was one of the first to suggest turkey hot dogs from 100 percent deboned turkey meat, Mendenhall said. Other products developed at that time were turkey ham, turkey pastrami, turkey bologna and turkey jerky. The department also tried more exotic turkey byproducts such as simulated shrimp, crab and lobster.

"We formed the turkey meat fibers into familiar shapes and added the natural seafood flavors, but the products didn't make it through the taste tests," Mendenhall said. "The turkey and seafood flavors just weren't compatible."

Mendenhall's creativity is a plus when it comes to transferring a project to a marketable product, Verge said.

"When we're dealing with people in the marketing business who say they have a problem with something, he'll come back and work on it and find a solution," Berge said. "I've seen him do it time after time. He's a rare combination for a professor: he's an outstanding teacher, an outstanding researcher and also a very pragmatic man."

# Spacemaker

Thursday, March 21, 1996

McClellan Air Force Base, Calif.



Maj. Gen. Eugene Tattini, SM-ALC commander, and Robert Molino, executive director for procurement, HQ DLA, sign the Memorandum of Agreement for PartNet. Looking on is Bruno Hildebrandt, SM-ALC PartNet project manager.

## PartNet streamlines acquisition process

By Eric Ritter  
Staff writer

A new internet-based catalog of components that aims to speed and simplify the parts research and acquisition process was introduced Thursday to a cross-section of potential SM-ALC users.

PartNet, developed for the Defense Logistics Agency (DLA) by Utah-based NTEC, is being pilot-tested at SM-ALC after 18 months of preliminary testing by

McClellan's Technology and Industrial Support Directorate. PartNet is a cooperative research and development effort between PartNet/NTEC (University of Utah), FAST (University of Southern California), Newark Electronics, HQ-DLA and SM-ALC.

The system would combine technical data with inventory and pricing information, allowing customers to research, order and purchase parts from a central location in

cyberspace.

"The idea behind PartNet is: 'Have IMPAC credit card, can do parts research and buy,'" SM-ALC project manager Bruno Hildebrandt said. Currently, the system comprises the more than 125,000-item catalog of Newark Electronics, Chicago. The system's backers hope PartNet will gain acceptance at the command, Air Force, and DoD levels encouraging more vendors to come online. The system has been designed in conjunction with the Air Force Materiel Command's supply reengineering team and will complement the Air Force Lean Logistics initiative.

Without question, the system has potential to streamline the parts research and acquisition process. Currently the process of designing a new single layer circuit board takes an average of 180 days, of which 154 are spent researching and acquiring parts. PartNet aims

See PartNet, Page 3

# PartNet

Continued from Page 1

to vastly reduce that time span.

But as much as engineer Mohammed Arshad, SM-ALC/TIEFD, would like to rid his desk of the databooks that battle for valuable desktop real estate, he isn't ready to do so just yet.

"A lot of time could be saved using PartNet," Arshad said. "You can do a parts search in a couple of minutes. But if I have to do my research for the part using a printed databook then it's faster to just call a 1-800 number."

To win over users like Arshad, the system will need more vendor participation, more extensive search capabilities, and more technical information. All of these are in the process of being brought online, Hildebrandt said, with priority given to those parts which currently require the most extensive research. Eventually the system will incorporate complete databook information, detailed search capability, and instantaneously updated inventory and pricing information from multiple vendors.

The resistor catalog is the most extensively developed database to date. A user first enters the electronic parts section of PartNet then proceeds to the resistors section. The user then chooses a specific kind of resistor, such as a variable resistor. The user can then narrow the search by specifying a number of attributes specific to resistors. The system then returns a list of vendors who have the resistor in stock, the quantity in stock, and the price. The part can then be purchased online with a General Services Administration IMPAC credit card and shipped overnight. If necessary, the user can view specific technical information about the part or refine the search. Although PartNet development has so far focused on research-intensive electronic parts, it could eventually include any component DLA customer would need, Hildebrandt said. PartNet is on the worldwide web at <http://part.net/>. A specialized browser is available for the Windows 95 and Windows NT platforms. Support for Windows 3.1 and unix, and an interface for legacy systems such as G004 and D035 are being considered. For information, call Bruno Hildebrandt, 643-2991.

**LEGISLATION FORMING THE CENTERS OF EXCELLENCE PROGRAM**

**PART 6  
Centers of Excellence**

**9-2-601.Purpose.**

(1) The Legislature recognizes that the growth of new industry and expansion of existing industry requires a strong technology base, new ideas, concepts, innovations, and prototypes. These generally come from strong research colleges and universities. Technical research in Utah's colleges and universities should be enhanced and expanded, particularly in those areas targeted by the state for economic development. Most states are enhancing their research base by direct funding, usually on a matching basis. The purpose of this part is to catalyze and enhance the growth of these technologies by encouraging interdisciplinary research activities in targeted areas. The Legislature recognizes that one source of funding is in matching state funds with federal funds and industrial support to provide the needed new technologies.

(2) The Legislature recommends that the governor consider the allocation of economic development funds for Centers of Excellence to be matched by industry and federal grants on at least a two-for-one basis.

(3) The Legislature recommends that such funds be allocated on a competitive basis to the various colleges and universities in the state. The funds made available should be used to support interdisciplinary research in specialized Centers of Excellence in technologies that are considered to have potential for economic development in this state.

**History:** C. 1953, 63-62-1, enacted by L. 1985, ch. 103, 1; 1986, ch. 109, 1; renumbered by L. 1992, ch. 241, 60.

**Amendment Notes.** - The 1992 amendment, effective March 13, 1992, renumbered this section, which formerly appeared as 63-62-1, and substituted "part" for "chapter" in Subsection (1).

**9-2-602. Short title - Definitions.**

(1) This part is known as the Centers of Excellence Act."

(2) As used in this part, "Centers of Excellence" means university-based, industry-supported, cooperative research and development programs.

**History:** C. 1953, 63-62-2, enacted by L. 1985, ch. 103, 2; 1986, ch. 109, 2; renumbered by L. 1992, ch. 241, 61.

**Amendment Notes.** - The 1992 amendment, effective March 13, 1992, renumbered this section, which formerly appeared as 63-62-2, inserted the subsection designations; and substituted "part" for "chapter" in two places.